



FILE COPY

Mr. Mark Verhey
Humboldt County Health Department
Division of Environmental Health
100 H Street, Suite 100
Eureka, California 95501

August 17, 2005

Re: Workplan for Evaluation of Shallow Water Bearing Zone & High Vacuum Dual-Phase Extraction Testing
Fortuna Beacon Petro Mart
390 South Fortuna Boulevard, Fortuna, CA
HCDEH LOP No. 12093
Blue Rock Project No. FNC-3

Dear Mr. Verhey,

This workplan is submitted by Blue Rock Environmental, Inc. (Blue Rock), on behalf of Humboldt Petroleum, Inc. (HPI), for (1) the evaluation of a shallow water bearing zone and vertical gradients and (2) testing of additional remedial technologies to enhance the current remediation system for the project located at 390 South Fortuna Blvd., Fortuna, California (site) (Figure 1). The Humboldt County Division of Environmental Health (HCDEH) earlier requested this type of evaluation in their letter dated February 14, 2005, and reiterated the same request in a meeting on June 2, 2005 between Blue Rock and the HCDEH.

Background

Site Description

The site is located in a commercial and residential area of Fortuna, Humboldt County, California. The site is owned by Humboldt Petroleum, Inc.

Site History

In March 1989, four fuel underground storage tanks (USTs) were removed from the site in March 1989 (Figure 1). Delta Environmental Consultants, Inc. (Delta) of Rancho Cordova, California observed the tank removal, and initiated a site investigation. The site is currently under the oversight of the HCDEH.

Site Investigation History

Subsurface investigation activities have been ongoing at the site since 1989. A total of approximately 29 soil borings (CPT-1 through CPT-8, SW-1 through SW-20, and HP-1) have been drilled at the site (Figure 2). Additionally, approximately 20 monitoring wells at the site: 17 shallow monitoring wells (MW-1 through MW-8, MW-10 through MW-16, and RW-4B and RW-5, screened no deeper than 20 feet bgs) and three deep wells (DW-1 through DW-3,

screened from 30 to 40 feet bgs). Well construction is summarized on Table 1, and historical soil sampling and groundwater monitoring data are summarized on Tables 2 and 3, respectively.

Summary of Contaminant Type

The predominant contaminant types that have been detected in the subsurface include total petroleum hydrocarbons as gasoline (TPHg), benzene, toluene, ethylbenzene, and xylenes (BTEX), and methyl tert-butyl ether (MTBE).

Summary of Hydrogeology

The first couple feet below grade consists of baserock fill. The site is underlain by sediments characterized as fine-grained soil (CL/ML) from ~2 feet bgs to depth of ~15 feet bgs, and lenses of sand and gravel have been described locally in this unit at a depth of approximately 5 feet bgs. This fine-grained unit is underlain by sands (SW) and gravel (GW) from ~15 to 22 feet bgs. From ~22 to ~26 feet bgs, which is underlain by sands and gravels to a depth of ~40 feet bgs (the maximum depth explored), except for the area of DW-3 where sand appears to be continuous in depth from ~15 to ~40 feet bgs. Fence diagrams are shown on Figures 3a and 3b.

Many of the monitoring wells are screened from 5 to 20 feet bgs. Resulting static water levels have been several feet apart at times and may represent that the wells are screened across two water bearing zones. The shallow water levels observed MW-2, RW-4B, and MW-13 may be the result of a localized perched zone, as past drilling and excavation observations possibly indicate thin, laterally discontinuous zones at depths of approximately 5 feet bgs. These conditions have been specifically observed during previous drilling of wells MW-1, MW-2 and MW-11, as intersecting a seasonal (December through June) shallow water-bearing (perched) zone (~4-8 feet bgs). Additionally, during the drilling of DW-1 through DW-3 in April 1996, soil samples collected at a depth of approximately 5 feet bgs were described as "wet", yet no water collected in the borehole. Also, during drilling of RW-4, the hole was dry to a depth 20 feet. RW-4 was drilled with the intention to collect and remove LNAPL on groundwater; however, no water entered this borehole and it was grouted without construction of a well. It is unknown how long previous borings were left open, and at which depths, to allow water to accumulate.

During the excavation of EX-2, the condition of the hole was observed and photographed at depths of 5, 8, and 12 feet bgs; however, no water accumulated at those depths. Excavation of EX-2 continued, and water with floating LNAPL was encountered at a depth of approximately 14 feet bgs, which began to rise rapidly. This condition suggests that this water bearing zone may be confined.

During the excavation for EX-1, the condition of the hole was similar to that for EX-2, except for the following observations. A thin (~1 foot thick) lens at approximately 10 feet bgs contained water, which slowly dripped down the sidewall. During excavation of EX-1, water with floating LNAPL was encountered at a depth of approximately 20 feet bgs, which also rose rapidly. Stabilized water level in the excavation after standing for a night was approximately 16 to 17 feet bgs.

Summary of Remedial Efforts

An active LNAPL skimming system was installed at the site and operated from 1991 to 1998. LNAPL was skimmed from wells MW-1, MW-4, and MW-5. It was estimated that this active LNAPL skimming system removed approximately 1,369 gallons (~8,350 lbs of gasoline). Hand-bailing and/or passive LNAPL skimming has been ongoing since 1998. Currently, a passive skimmer is deployed in MW-6; however, no wells at the site including MW-6, have contained measurable thicknesses of LNAPL since June 2003.

In August 2001, Clearwater performed remedial activities detailed in the *Final Remedial Action Plan Addendum*, dated January 19, 2001. Approximately 1,241 tons of hydrocarbon contaminated soil were removed from the site and treated at BioIndustries in Red Bluff, California. Assuming the excavated soil contained an average TPHg concentration of 880 mg/kg (see soil sample results for RW-1 through RW-3 which were formerly located in the area of the remedial excavation, Table 2), the total gasoline mass removed by excavation was estimated at ~2,184 lbs. Approximately 9,500 gallons of hydrocarbon contaminated groundwater were removed from the excavation to facilitate digging operations and the installation of groundwater extraction trenches (EX-1 and EX-2). Pilot testing results determined pumping rate, discharge time and recharge time for each groundwater extraction trench. Results of these activities are presented in Clearwater's *Soil Excavation, Extraction Trench Installation and Groundwater Extraction Pilot Testing Report*, dated September 21, 2001.

In August 2002, the groundwater extraction and treatment system became operational. The system continues to operate by extracting groundwater from EX-1 and EX-2. As of June 2005, it was estimated that approximately 2,000,000 gallons of groundwater has been extracted and 260 lbs of gasoline recovered.

The total estimated gasoline mass recovered to date through remedial efforts is ~10,800 lbs (8,350 lbs by LNAPL removal, 2,184 lbs by soil excavation, and 260 lbs by groundwater extraction).

Workplan for Evaluation of Shallow Water Bearing Zone

The purpose of this phase of work is to evaluate the potential and nature of a perched water bearing zone (A Zone) at approximately 3 to 10 feet bgs and its relationship to a lower zone (B Zone) from approximately 15 to 20 feet bgs.

In order to evaluate these conditions, a set of three nested wells is proposed, as this will facilitate calculation of lateral groundwater flow in each zone and facilitate measurement of potential vertical gradients between the A and B zones. It should be noted that existing wells are generally screened from 5 to 20 feet bgs, and, therefore, are not suitable for this evaluation, as they potentially cross the two depth intervals interest. Blue Rock proposes the installation three nested well sets (well locations shown on Figure 4 and tentative well construction is shown on Figure 5):

- MW-17A and MW-17B: Located along the western edge of the site, just south of the mini-mart building.
- MW-18A and MW-18B: Located at the southwest corner of the site.
- MW-19A ad MW-19B: Located near the southeast corner of the dispenser islands/canopy.

The nested wells will be installed in individual boreholes separately laterally by approximately 5 feet. The nested wells screens will be separated vertically by at least 5 feet, so that potential vertical gradients between the two zones can be evaluated.

Drilling, Soil Sampling, and Installation of Nested Well Sets

Prior to drilling, Blue Rock will prepare site specific Health and Safety Plan and obtain well installation permits from HCDEH. Prior to conducting and drilling, the site will be marked by Underground Service Alert to identify utilities leading to the site. Additionally, a private utility locator may be employed to clear exact drilling locations.

A Blue Rock scientist, working under the supervision of a Blue Rock California Professional Geologist, will supervise all drilling and well installation activities. Drilling will be performed by a C-57 licensed driller using a truck-mounted rill-rig equipped with 8-inch diameter hollow-stem augers. During drilling, soil samples will be collected at five-foot intervals in a California Modified Split-Spoon sampler lined with clean, brass tubes. The Blue Rock scientist will log soil types in accordance with the Unified Soil Classification System. Additionally, soil samples will be screened for the presence of volatile petroleum hydrocarbon vapors with a photo-ionizing organic vapor meter (OVM).

It is estimated that up to three soil samples will be retained from each nested well location for laboratory analysis. These samples will be selected based on elevated OVM readings or field indications of contamination; however, the final set of samples selected will also represent a meaningful vertical array of samples from each boring. These samples will be covered with Teflon lined plastic caps, labeled, documented on a chain-of custody form, and placed on ice in a cooler for transport to the project laboratory.

Blue Rock will supervise construction of monitoring wells in the boreholes. Well screens will target two zones: the A zone wells will be screened from 3 to 10 feet bgs, and the B zone wells will be screened from 15 to 20 feet bgs. The wells will be constructed of clean, flush-threaded, two-inch diameter PVC well materials. Well screen will consist of 0.01-inch slot. A filter pack of Lonestar #2/12 sand will extend from the bottom of each boring to one feet above the screened interval. The filter pack will be sealed by a one-foot layer of hydrated bentonite. The remaining annular space will be filled with cement and a tamper-resistant box will be concreted in place over the wellhead.

Well Development and Survey

The wells will be developed by surging and bailing no earlier than 72 hours following installation. Development will involve the removal of water from each well until such time that it is relatively free of sediment, and pH, temperature, and conductivity parameters have stabilized. It is anticipated that the water volume removed will not exceed 10 saturated casing volumes. The new wells and sampling points will be surveyed according to GeoTracker requirements.

Well Sampling

Following drilling and well installation activities, Blue Rock will incorporate the new wells into the existing quarterly groundwater monitoring program for the site.

Prior to purging or sampling, an electronic water level indicator accurate to within ± 0.01 -ft will be used to gauge depth to water in each well. All wells will also be checked for the presence of light non-aqueous phase liquids (LNAPLs) prior to sampling.

The wells will be purged of groundwater until such time that the parameters pH, temperature, and conductivity have stabilized. At a minimum, parameter measurements will be taken at every saturated well casing volume purged. A minimum of three saturated casing volumes will be purged, unless the well goes dry, but no more than five saturated casings volumes will be removed.

Following recovery of water columns to at least 80% of their static levels, or after passage of two hours (if designated recovery levels have not occurred), groundwater samples will be collected from the monitoring wells using polyethylene sampling bailers. Samples will be decanted into laboratory supplied containers, labeled, documented on a chain-of-custody form, and placed on ice in a cooler for transport to the project laboratory.

Soil and Groundwater Sample Analyses

The soil and groundwater samples will be analyzed by a California DHS-certified laboratory for:

- TPHg, BTEX, and MTBE by EPA Method 8260B.

Decontamination and Management of Investigation Derived Soil and Water

Prior to, and between, use all downhole drilling and sampling equipment will either be steam-cleaned or washed in an Alconox® solution followed by double rinse in clean tap water. Soil cuttings and auger/sampler rinseate will be stored in labeled 55-gallon drums on-site pending appropriate disposal. Blue Rock will utilize the analytical results for soil and/or water samples collected from the borings to coordinate soil and water recycling/disposal.

Evaluation of Existing Soil Contamination Data

Blue Rock reviewed cumulative site data to evaluate the potential contaminant mass remaining in-situ relative to current remediation process rates for the purposes of identifying potential data gaps and the potential need for more rapid contaminant recovery.

Estimation of Current Sorbed-Phase Gasoline Mass

Historical soil sample data were used to estimate the residual mass of sorbed-phase gasoline contaminants at the site. The current mass of sorbed-phase contaminants is of interest because it likely represents over 90% of the current contaminant mass at the site, now that LNAPL has been effectively removed and because the dissolved-phase mass is usually low relative to the other physical phases of the contaminants.

The extent of residual sorbed-phase contamination appears to be relatively well delineated by previous investigation efforts. The core of the residual sorbed-phase TPHg plume appears to be centered near the former UST location (now EX-1) and extend toward the fuel dispensers and west/northwest (Figures 6a through 6d). The vertical extent of soil contamination appears to be defined near the source (i.e. former USTs) by samples from DW-1 to 39 feet bgs, which shows soil contamination above 1 mg/kg TPHg does not extend significantly beyond 21 feet bgs (Table 2).

Using cumulative investigation data, the volume of soil with TPHg greater than 100 mg/kg was calculated. Two calculations were made: the first calculation assumes that contamination does extend beneath the dispenser islands, and the second calculation assumes that contamination does not extend beneath the dispenser island. The purpose of these two calculations is to evaluate if the area underneath the dispensers would significantly alter the mass calculations and therefore warrant additional sampling in that area.

Assuming that contamination does extend beneath the dispenser islands, the footprint of contamination is generally about 6,000 ft² with a thickness of approximately 20 ft (2.5 to 22.5 feet bgs). The resulting in-situ volume is approximately 120,000 ft³ (4,400 yd³). For the sake of accuracy, the contaminated volume and mass were modeled essentially as discrete depth intervals with calculated average TPHg concentrations specific to each interval (calculations are attached). The estimated residual sorbed-phase TPHg mass, assuming contamination does extend beneath the dispensers, is about 5,900 lbs (equivalent to 960 gal. of liquid gasoline). See Figures 6a through 6d for the extent of soil contamination from 5 to 20 feet bgs.

Assuming that contamination does not extend beneath the dispenser islands, the footprint of contamination is generally about 4,300 ft² with a thickness of approximately 20 ft (2.5 to 22.5 feet bgs). The resulting in-situ volume is approximately 86,000 ft³ (3,200 yd³). For the sake of accuracy, the contaminated volume and mass were modeled essentially as discrete depth intervals with calculated average TPHg concentrations specific to each interval (calculations are attached). The estimated residual sorbed-phase TPHg mass, assuming contamination does extend beneath the dispensers, is about 4,300 lbs (equivalent to 710 gal. of liquid gasoline).

Due to the vagaries of sampling and interpolation, it should be recognized that these masses are an estimate and that the actual residual sorbed-phase mass may be upwards of 50% higher or lower. The two estimated contaminant masses are within about 27% to 37% of each other, and, therefore, appear to be within limits of accurate estimation. Because these two estimates do not differ significantly, along with the recognition that these estimates tend to be on the low side, Blue Rock is of opinion that the calculated 5,900 lbs of TPHg is the better estimate to use. Further, professional experience with pre-remedial contaminant mass estimates versus actual masses remediated suggests that pre-remedial estimates tend to be on the lower side. Therefore, this estimate may be on the lower side of that actually in place.

Comparison Current Remediation Rates to Estimated Residual Gasoline Mass

The groundwater extraction system has been operational since September 2002. As of approximately June 1, 2005, the groundwater extraction system has recovered the following mass of TPHg: 260 lbs (equivalent to 43 gal. of liquid gasoline). The system currently extracts groundwater at total rate of about 6 gpm (from EX-1 and EX-2) and TPHg recovery rates have been about 0.67 lbs/day. In their letter dated February 14, 2005, the HCDEH noted that the ratio of volume of water pumped versus pounds of hydrocarbons removed has remained relatively unchanged, suggesting that the system is effectively removing hydrocarbons from the water. Thus, the current groundwater extraction system does provide an ongoing remedial benefit to the site; however, it is unclear if the contaminant recovery rates by groundwater extraction alone will remove a significant portion of the remaining gasoline mass, in order to achieve site closure in a timely fashion.

Groundwater extraction clean-up can have an affect on soil contamination, as soil contaminants continue to partition to the dissolved-phase that are then extracted and treated by the groundwater treatment system. At the current recovery of 0.67 lbs/day, it would take approximately 24 years to remove the total 5,900 lbs of gasoline, or approximately 12 years to remove half of that mass (i.e. 2,950 lbs). While it is recognized that complete contaminant mass removal is often not possible, mass removal to the extent that dissolved-phase concentrations decline toward clean-up goals in a timely fashion is typically needed before regulatory closure is contemplated. Based on the potential time-frames of clean-up by groundwater extraction alone discussed above, Blue Rock recommends evaluating other remedial options that would compliment the existing groundwater extraction system.

High-vacuum dual-phase extraction (HDPE) may be a useful remedial technology for the site because (1) it is suited for lower permeability soil types, (2) it removes contaminants in all phases thus enhancing overall contaminant recovery rates, and (3) it utilizes groundwater extraction and treatment (a technology that has already proven successful at the site). Low vacuum soil vapor extraction was previously tested at the site without favorable results; however, the significantly higher vacuums generated by this method, combined with a lowered water levels within the extraction well, may provide significantly different results.

Proposed High-Vacuum Dual-Phase Extraction Test

Purpose

Blue Rock proposes to perform a HDPE test to evaluate the potential efficacy of this remedial approach to augment current remedial efforts. The HDPE test can “piggy-back” on the existing groundwater extraction system. The fact that much of the soil contamination appears to be present at depths near or below groundwater means that depressing the water level in the HDPE test wells will be important in order to expose more soil contamination to the affects of vapor extraction. This can be accomplished using the existing groundwater extraction system.

A general description and discussion of HDPE written by the US EPA is attached for reference. HDPE testing equipment and methodology specific to the proposed test are described and explained below. Because pilot studies are investigatory in nature, in order to be of most value, testing will need to be flexible to adjust to results, as they are experienced in the field.

Air Permitting

A testing notification will be submitted to the North Coast Air Pollution Control District (APCD), but no formal air discharge permits are required for tests such as these. The APCD will be provided with any information related to test procedures and process stream treatment.

DPE Equipment

A mobile HDPE unit will be mobilized to the site. The unit is truck mounted and consists of liquid-ring pump capable of producing 25-inches Hg vacuum and a thermal oxidizer capable of treating an air flow of 250 cfm. An onboard electric generator powers the equipment and onboard propane tanks provide supplemental fuel for the thermal oxidizer. A unit intake hose will be connected to the well through a vacuum cap attached to the wellhead.

An OVM will be used to monitor influent air concentrations. A flow sensor will measure process air stream volumetric flow and a separate flow meter will record gallons of water pumped. Extracted water will be stored in a 5,000 gallon above-ground storage tank to be mobilized to the site.

HDPE Test Procedures

Extraction basins EX-1 and EX-2 will be utilized as the test points. These extraction basins are located in areas of previously observed contamination. The basins have screened intervals across previously documented soil contamination and contain impacted groundwater. These wells consist of 4-inch diameter construction, with screened intervals from approximately 5 to 25 feet bgs. The existing electric pumps can dewater these wells to a depth of about 20 feet bgs during the HDPE test.

All of the surrounding wells, without occluded screens, will be utilized for soil vapor vacuum radius of influence monitoring, and all wells will be used for groundwater drawdown monitoring. Prior to initiating test extraction, all monitoring wells will be opened and allowed to equilibrate. Two rounds of initial depth to water readings will be collected using a water sounder. Vacuum

caps will then be attached to the wells and background vacuum or pressure readings will be collected.

A stinger hose or pipe will be lowered into each test well through a vacuum tight cap. The stinger end will be placed at the top of the well to start, and then lowered into the well as ongoing test results dictate. The HDPE unit will be engaged and testing will begin. Mostly vapor, and possibly some water, will be extracted simultaneously by the high vacuum produced by the liquid-ring pump. The extraction rates of existing electric submersible pumps will be adjusted to maintain depressed groundwater levels within several feet of the well bottom. If needed, the stinger intake may be lowered into the well to aid in depressing the local water table, thereby maximizing the amount of screen exposed for vapor extraction.

HDPE testing will proceed over the course of approximately 5 days, at times using a single test well or a combination of test wells. The duration of the test is aimed at dewatering a portion of the uppermost saturated zone to determine how a full fledged system will perform. Field conditions experienced at the time of testing may warrant shortening the test. The test will not be extended beyond 5 operating days. During the first day of the test, extraction data will be collected at least hourly. Extraction data collected will include: applied vacuum, water pumping rate, process air flow rate, and field monitoring of hydrocarbon concentrations in process air. On the first test day, vacuum influence and depth to water data will be collected from the surrounding monitoring wells on an hourly basis. If conditions allow, the HDPE unit will be run overnight between test days, although only limited data will be collected during nighttime operations. As testing progresses data collection intervals will likely be lengthened.

Extracted water will be separated by a water knockout and transferred to a holding tank, and then pumped through the existing on-site system for treatment and discharge. Extracted air will be routed through the thermal oxidizer to thermally destroy (burn) entrained hydrocarbon vapor. A schematic of the test set-up is included in Figure 8.

Collection of Process Water and Soil Vapor Samples

On a daily basis, one influent air sample and one mid-fluent water sample will be collected for laboratory analysis from the respective process streams of the high vacuum unit. The water sample should be considered a mid-fluent sample because it will have been partially stripped of dissolved hydrocarbons by the HDPE process. Theoretically, the stripped hydrocarbon contaminant mass will be accounted for in the air sample results. The air samples will be collected into 1-liter tedlar bags and the water samples will be collected into preserved 40-milliliter VOA bottles.

Laboratory Analyses of Water and Soil Vapor Samples

The samples will be labeled, documented on a chain-of-custody form, and transported to a licensed analytical laboratory. The air and water samples will be analyzed for:

- TPHg, BTEX, and MTBE, by EPA Methods 8260B (air and water samples)

Treatment of HDPE Testing Derived Water

The HDPE test derived water will be transferred to the existing on-site remediation system for treatment and discharge to the City sewer under existing permit.

Proposed Schedule

Following receipt of regulatory approval of this workplan, Blue Rock will install and sample the proposed wells within 30 days, barring any access issues. The HDPE test will follow well installation so that the new wells can serve as observation points. The HDPE will be performed within 30 days of well installation and sampling. The report for the additional investigation and DPE testing will follow 45 days following completion of HDPE testing.

Reporting

Blue Rock will prepare a report following this phase work. The report will include description of field and laboratory methods, results, discussion/interpretation, and recommendations, as conditions warrant. The report text will be supported by tabulated data and drawings. The report will be prepared under the supervision of, and signed by, a California Professional Geologist at Blue Rock.

Certification

This workplan was prepared under the supervision of a California Professional Geologist at Blue Rock. All statements, conclusions, and recommendations are based upon published results from past consultants, field observations by Blue Rock, and analyses performed by a state-certified laboratory as they relate to the time, location, and depth of points sampled by Blue Rock. Interpretation of data, including spatial distribution and temporal trends, are based on commonly used geologic and scientific principles. It is possible that interpretations, conclusions, and recommendations presented in this report may change, as additional data become available and/or regulations change.

Information and interpretation presented herein are for the sole use of the client and regulating agency. The information and interpretation contained in this document should not be relied upon by a third party.

The service performed by Blue Rock has been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions in the area of the site. No other warranty, expressed or implied, is made.

If you have any questions regarding this project, please contact us at (707) 441-1934.

Sincerely,
Blue Rock Environmental, Inc.

Prepared by:

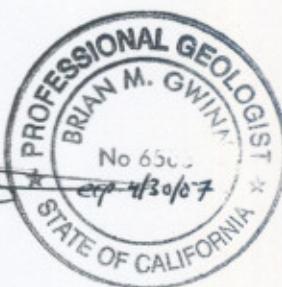


Scott Ferriman
Project Scientist

Reviewed by:



Brian Gwinn, PG
Principal Geologist



Attachments:

- Figure 1: Site Location Map
- Figure 2: Site Plan
- Figure 3a: Fence Diagram A-A'
- Figure 3b: Fence Diagram B-B'
- Figure 4: Proposed Well Locations
- Figure 5: Proposed Well Construction Diagram
- Figure 6a: TPHg in Soil at 5'
- Figure 6b: TPHg in Soil at 10'
- Figure 6c: TPHg in Soil at 15'
- Figure 6d: TPHg in Soil at 20'
- Figure 7: Dissolved-Phase TPHg Distribution Map – 6/1/05
- Figure 8: HDPE Test Schematic

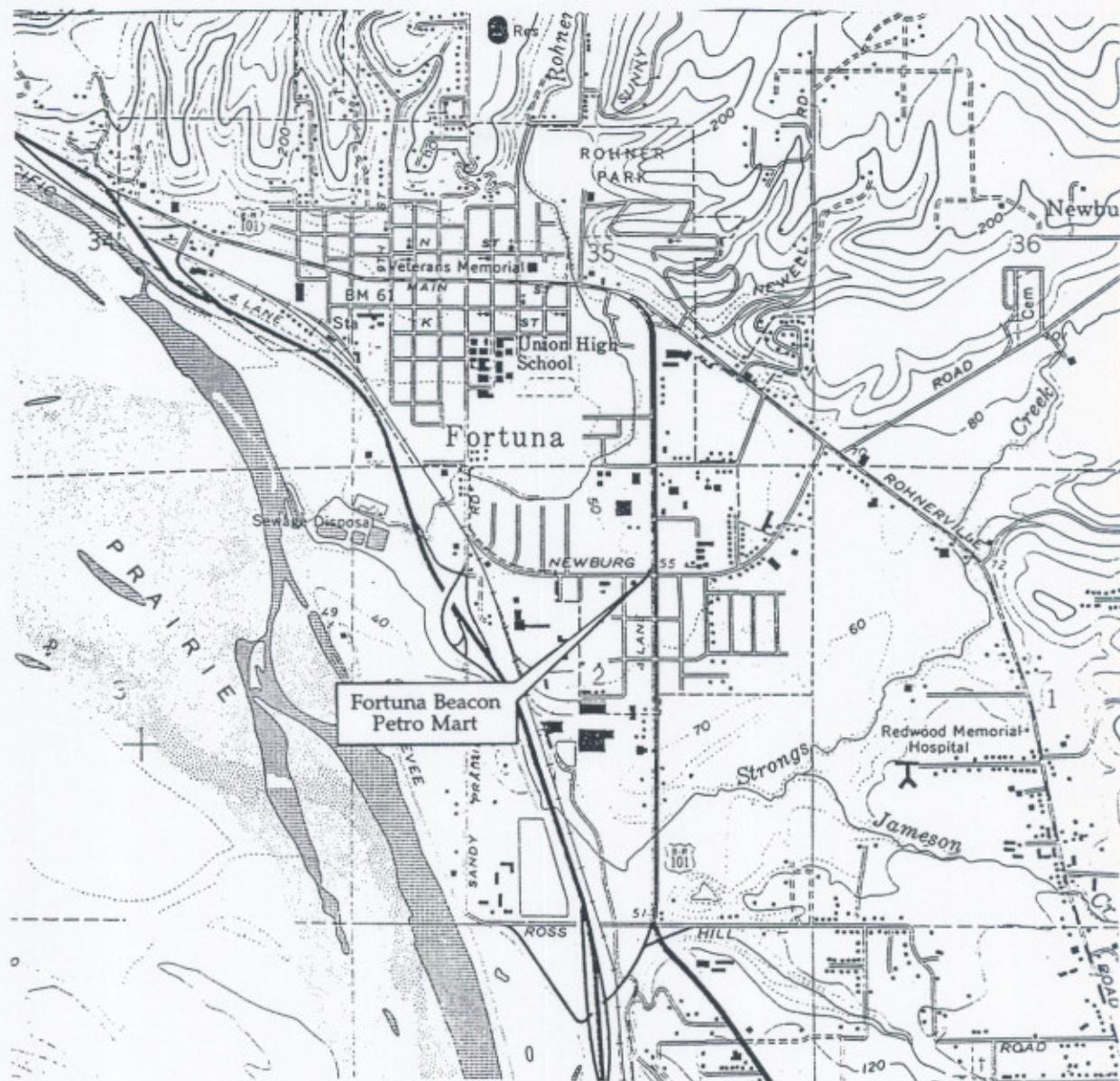
- Table 1: Well Construction Details
- Table 2: Soil Sample Analytical Data
- Table 3: Groundwater Elevations and Analytical Results

- Calculation of Residual TPHg in Soil (Does Extend Beneath the Dispensers)
- Calculation of Residual TPHg in Soil (Does Not Extend Beneath the Dispensers)

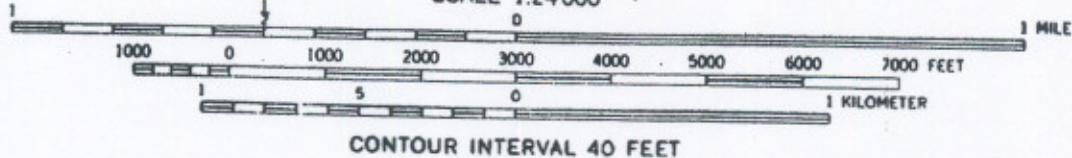
- Dual-Phase Extraction - Excerpt from How to Evaluate Alternative Clean-up Technologies for Underground Storage Tank Sites: A Guide for Corrective Action (EPA 510-B-95-007)

Distribution:

- Mr. Jim Seiler, Humboldt Petroleum, Inc. P.O. Box 131, Eureka, CA 95502



SCALE 1:24 000



CONTOUR INTERVAL 40 FEET



MAP SOURCE: USGS Fortuna Quadrangle



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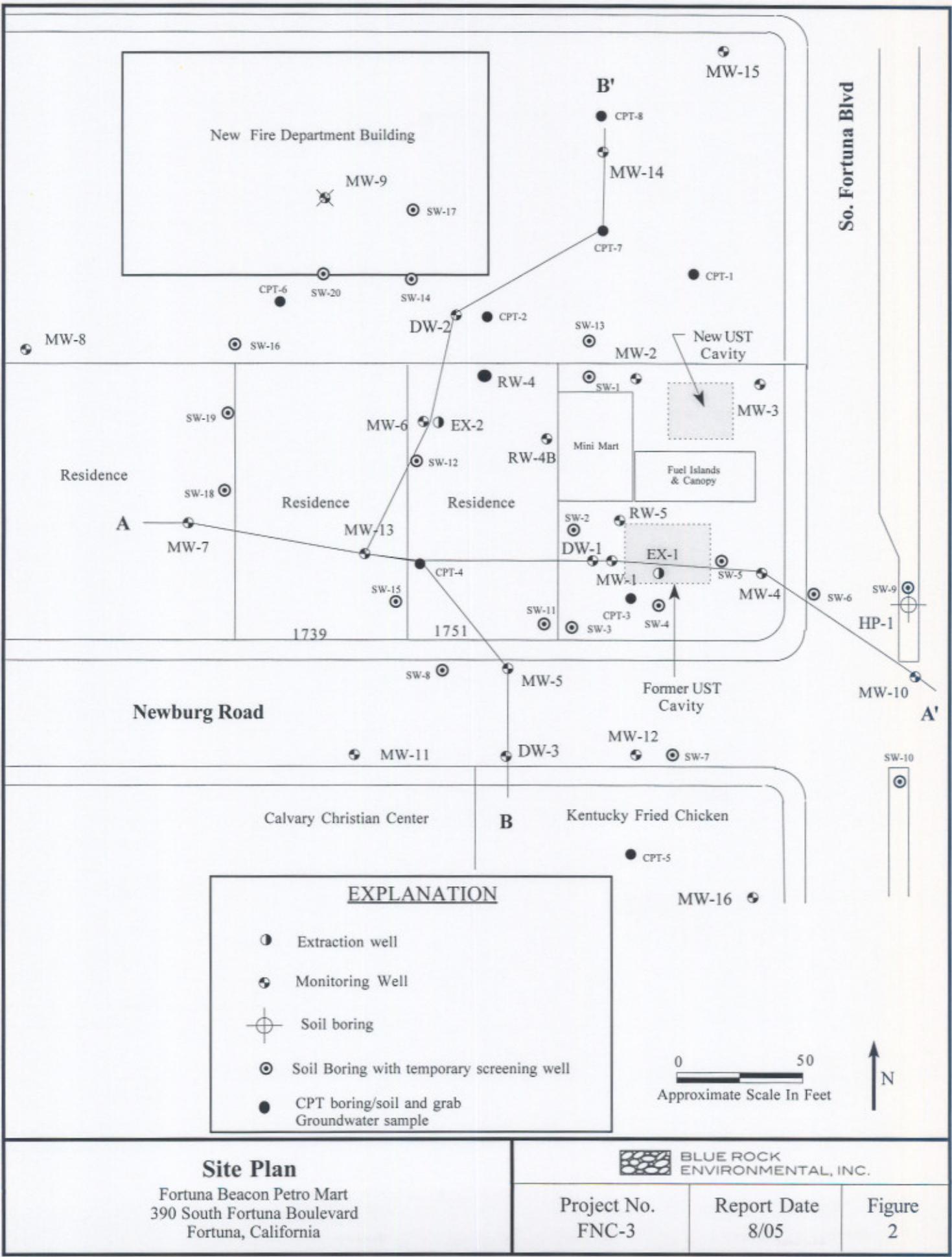
Site Location Map

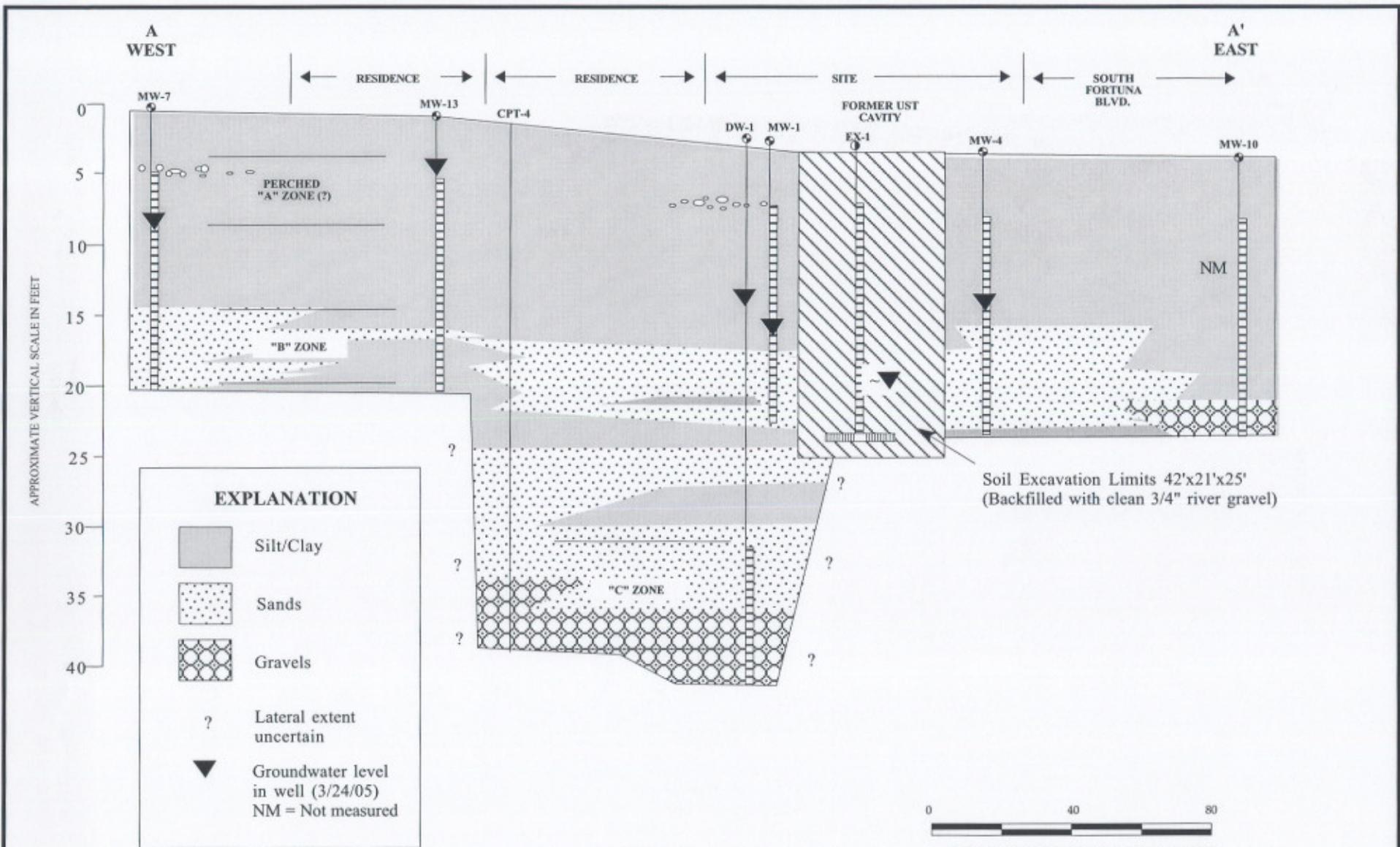
Fortuna Beacon Petro Mart
390 South Fortuna Boulevard
Fortuna, California

Project No.
FNC-3

Date
7/04

Figure
1





Fence Diagram A-A'

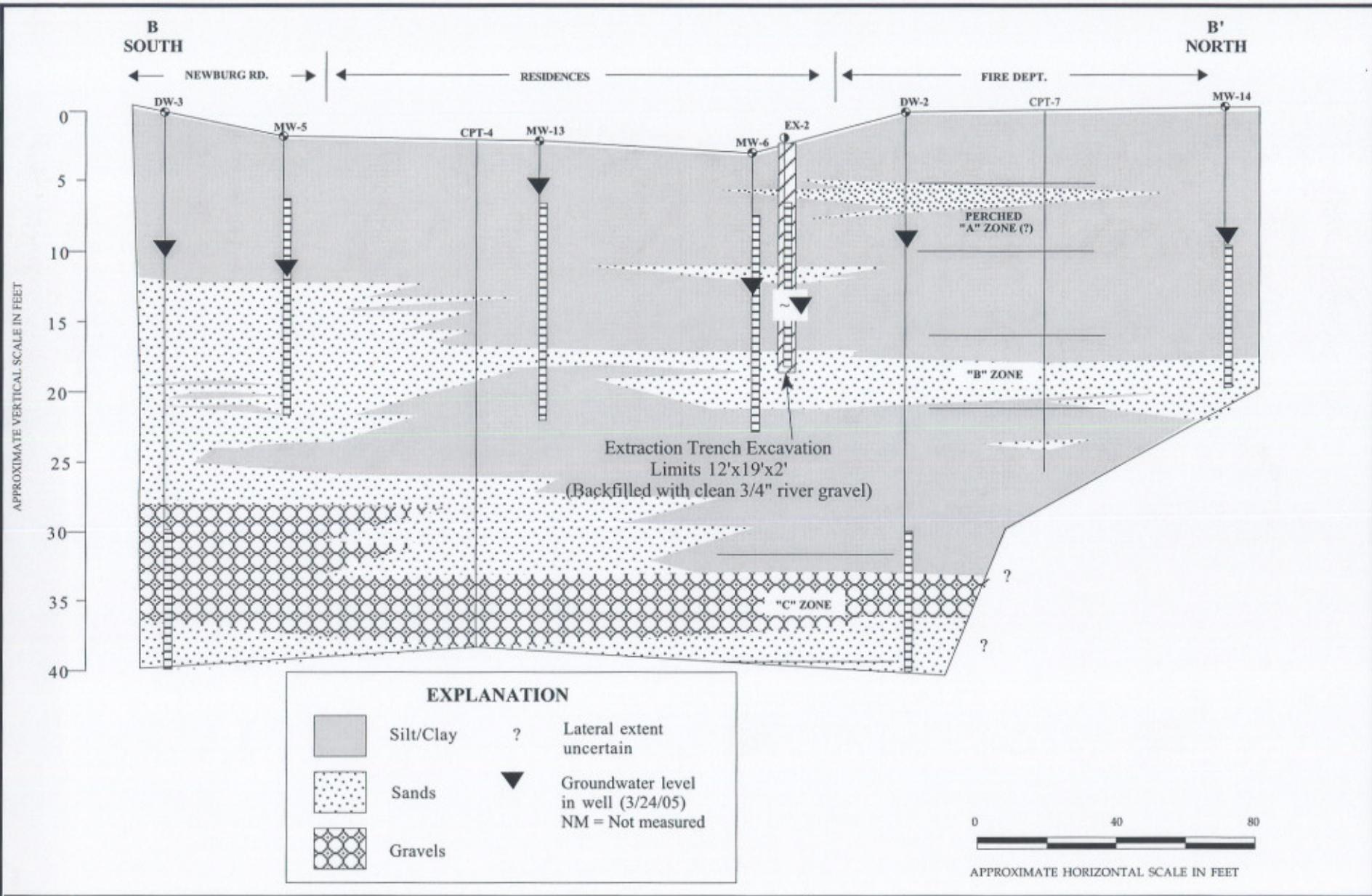
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Fortuna, California

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Report Date
8/05

Figure
3a



Fence Diagram B-B'

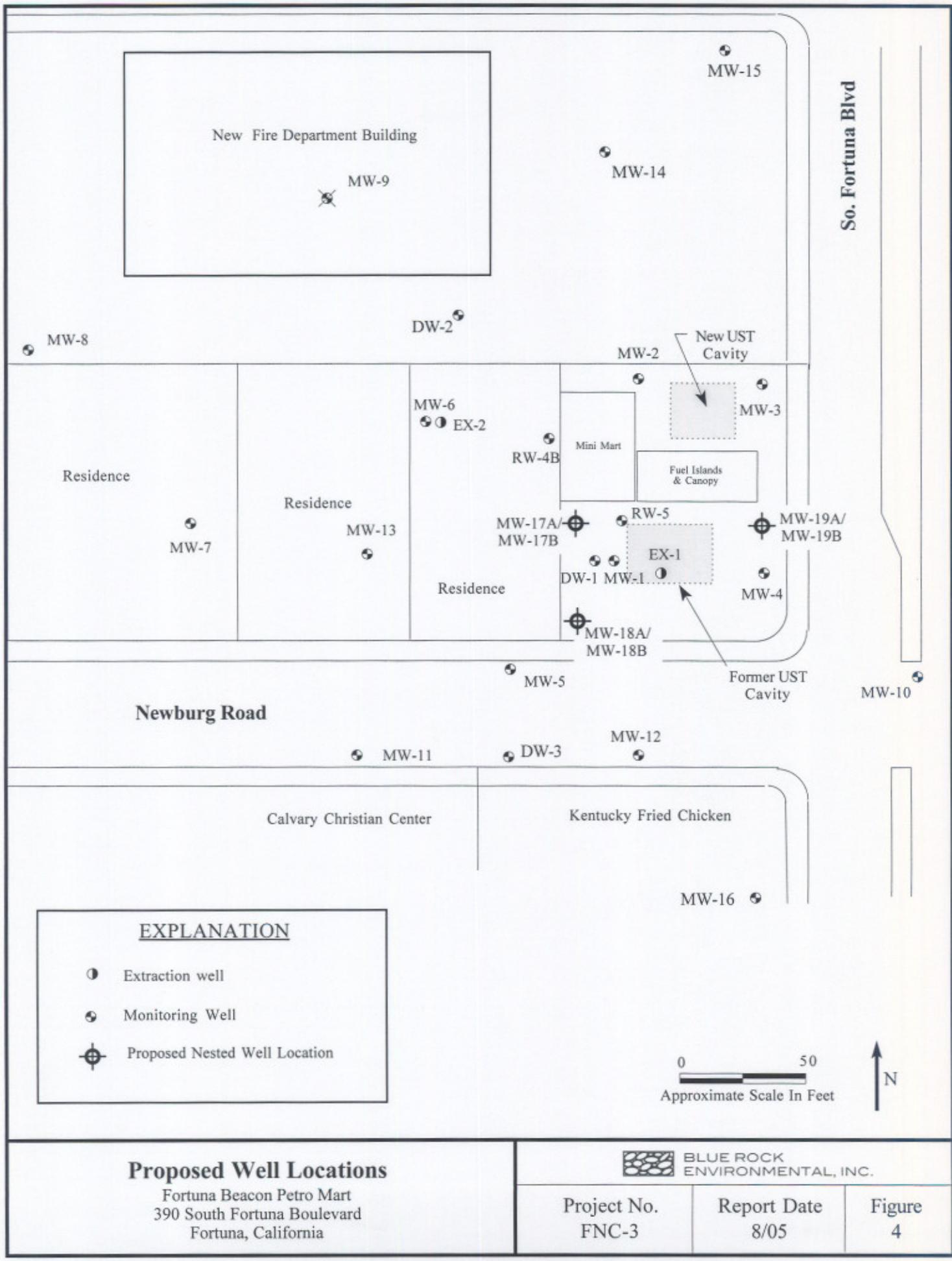
Fortuna Beacon Petro Mart
390 South Fortuna Boulevard
Fortuna, California

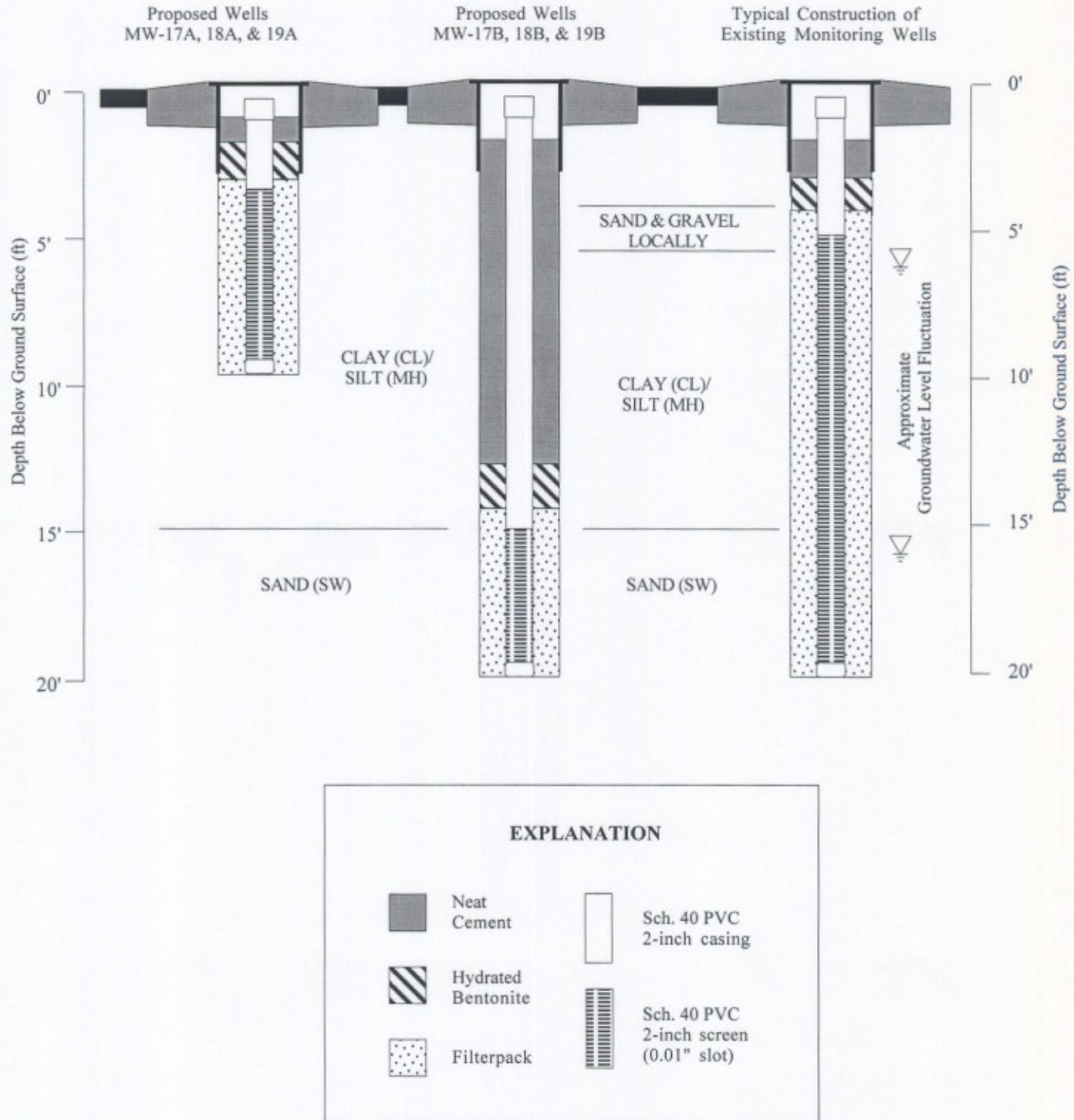
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Figure
3b





NOT TO SCALE

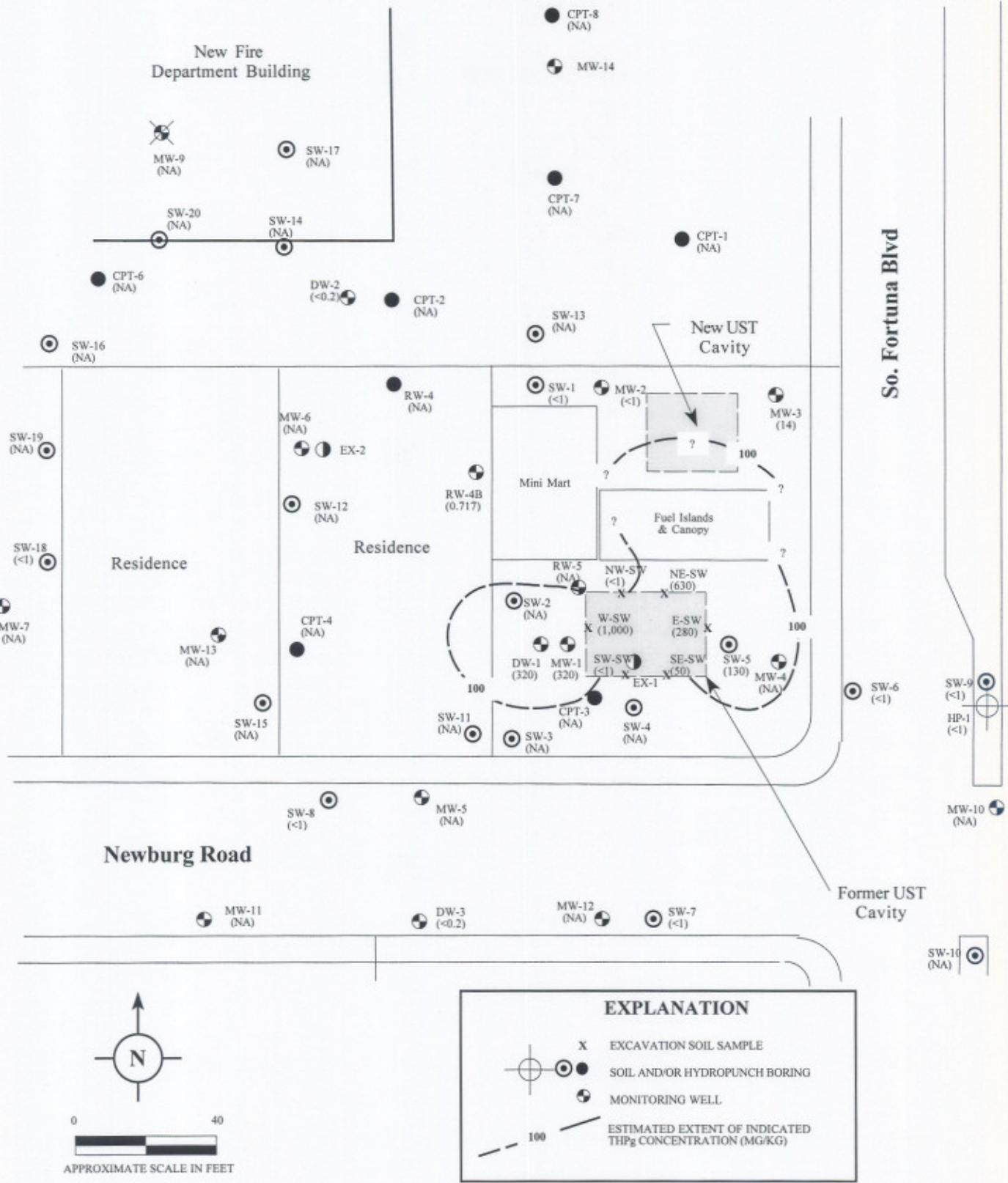
Proposed Nested Well Construction Details
 Fortuna Beacon Mini Mart
 390 S. Fortuna Blvd.
 Fortuna, CA

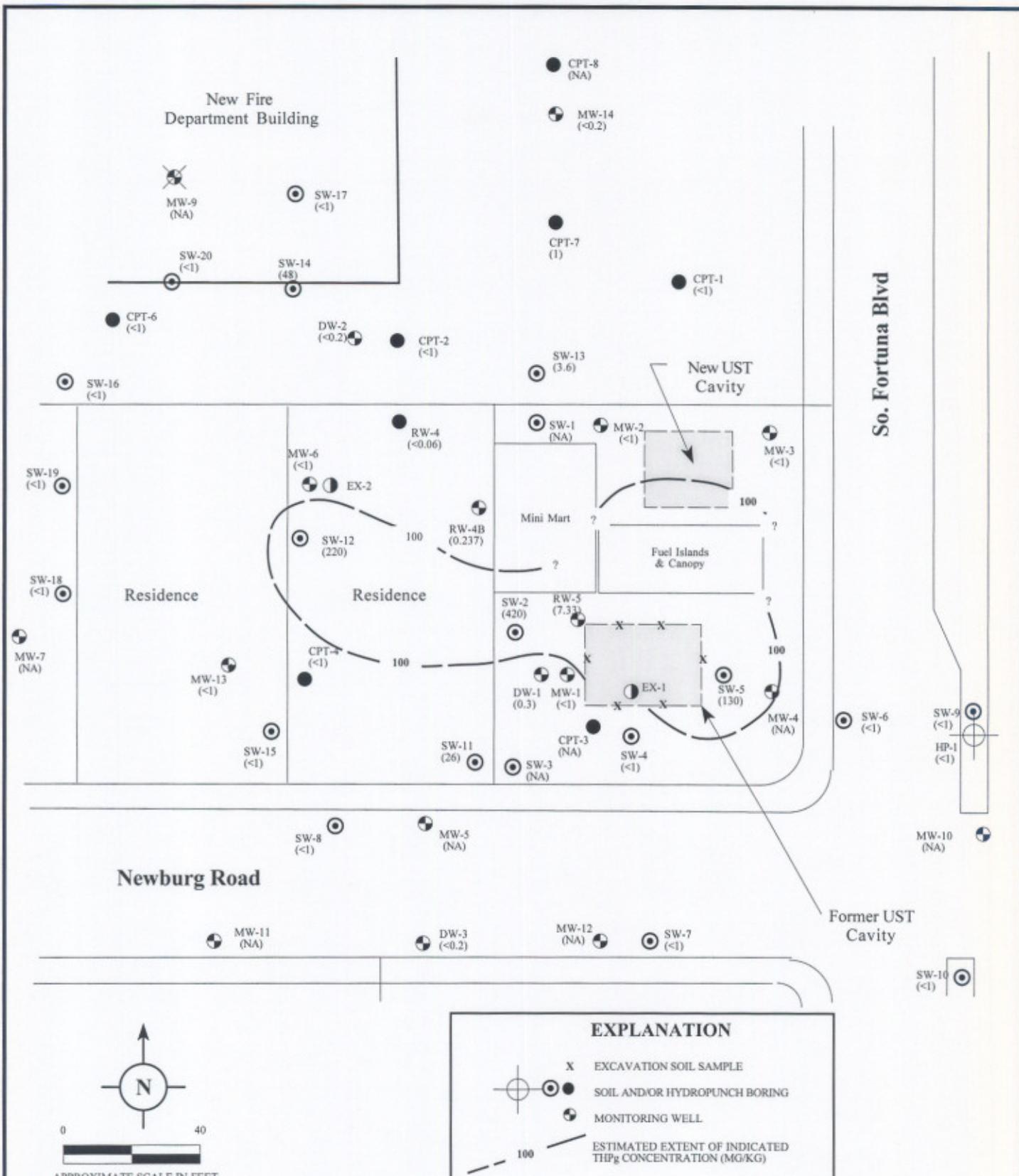
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Figure
5



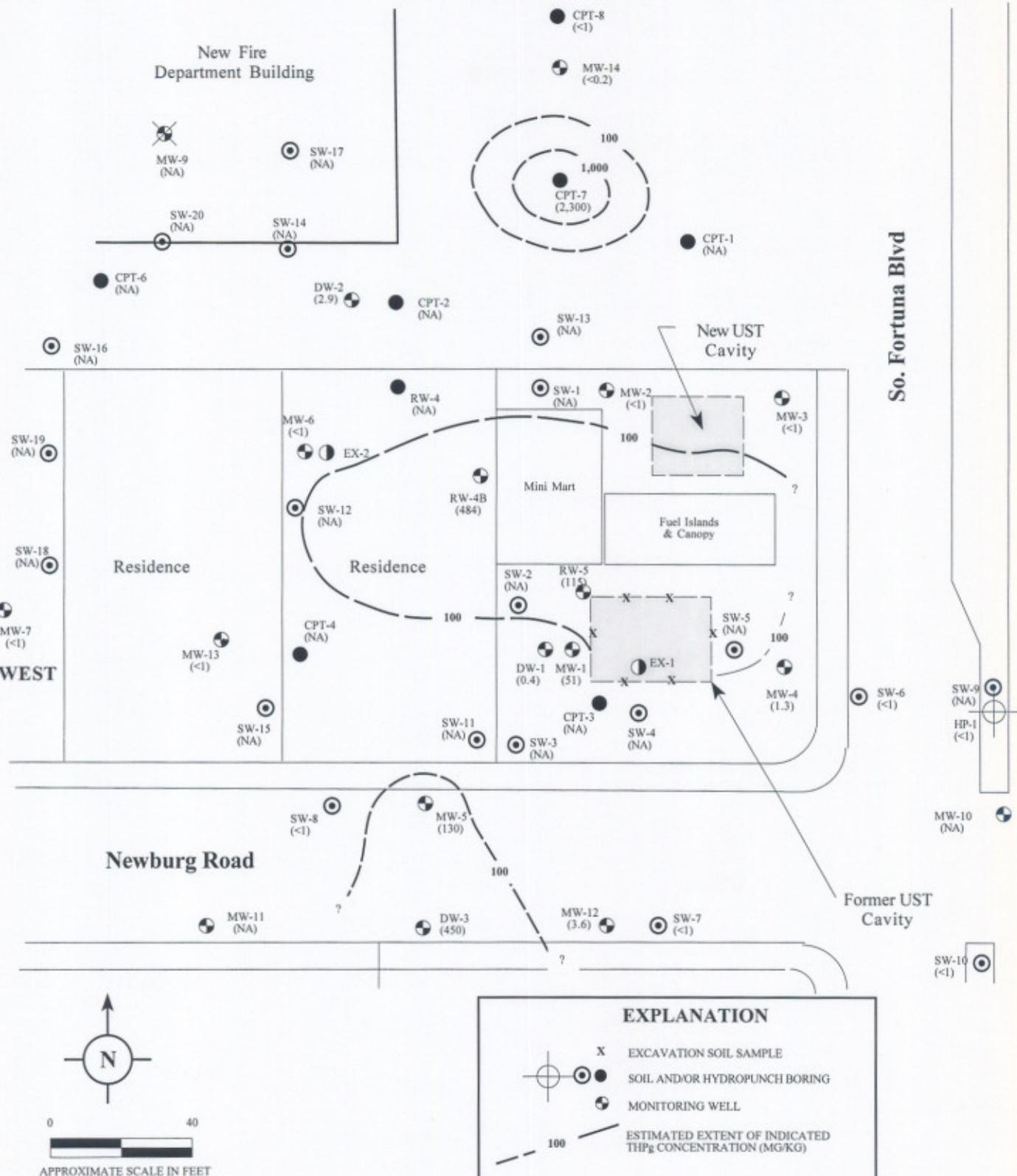


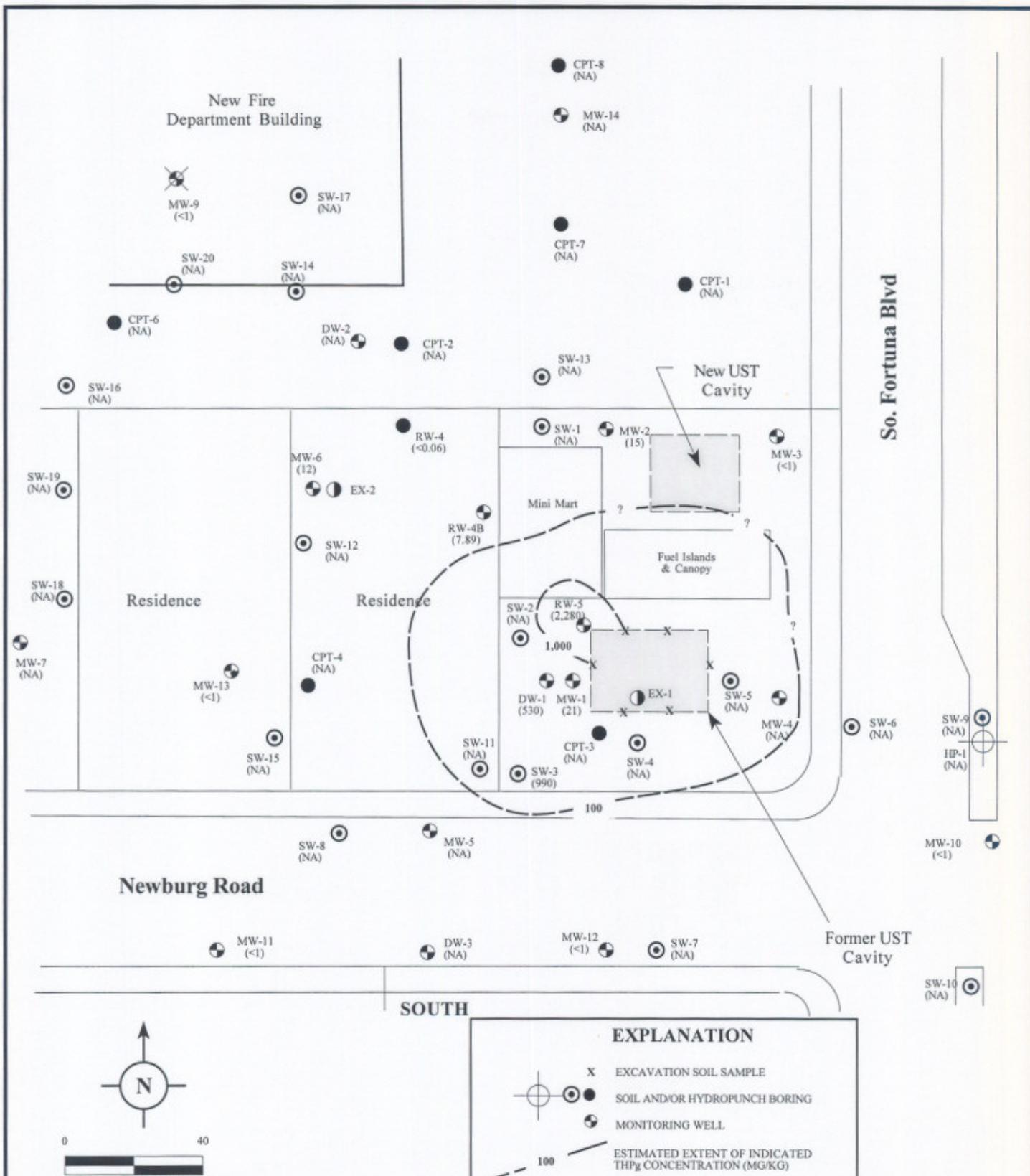
TPHg in Soil at 10'
Fortuna Beacon Petro Mart
390 South Fortuna Blvd
Fortuna, CA

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Project No. FNC-3 Report Date 8/05

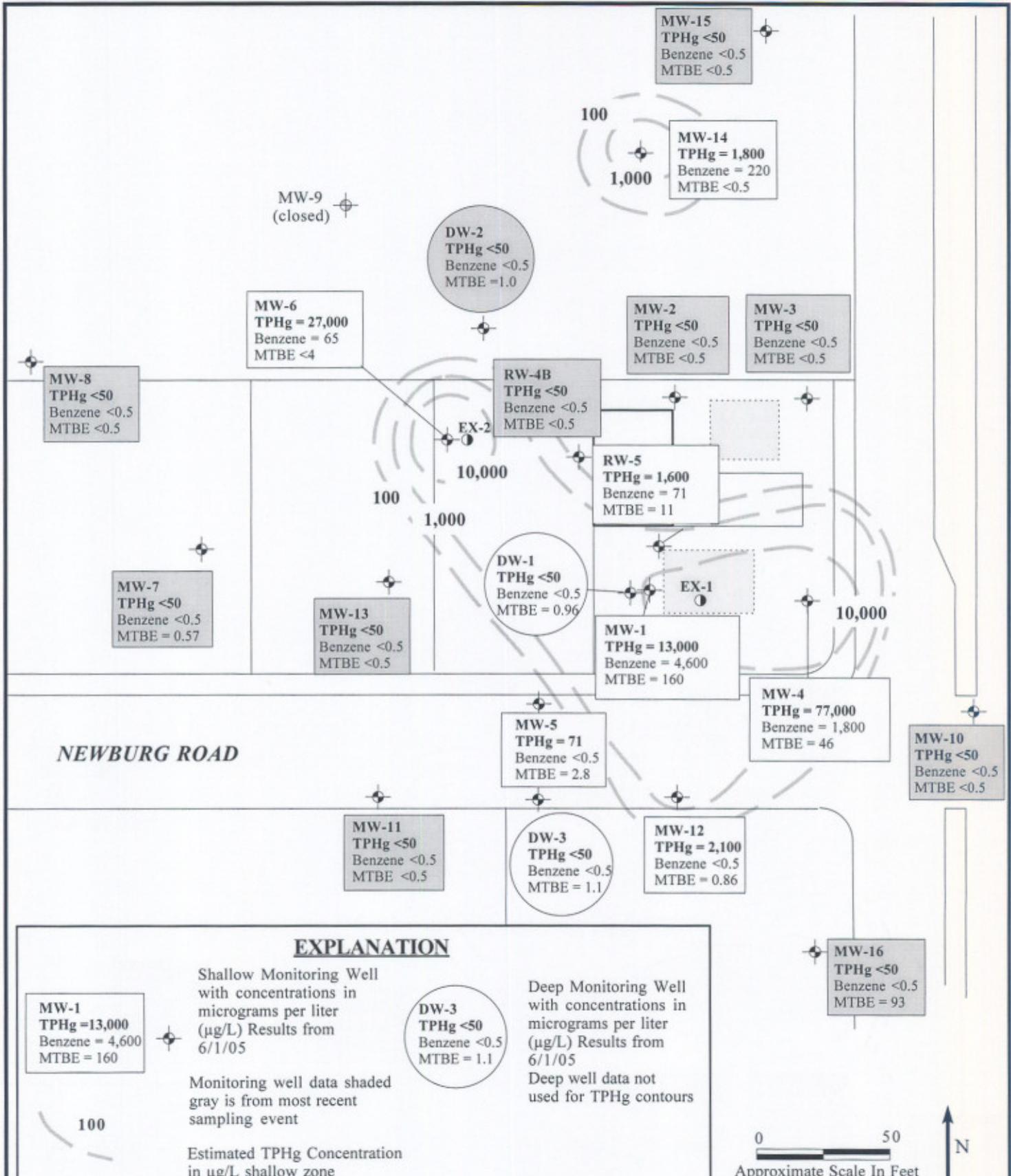
Figure 6b





TPHg in Soil at 20'
Fortuna Beacon Petro Mart
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Fortuna, CA

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Dissolved-Phase TPHg Distribution Map
6/1/05

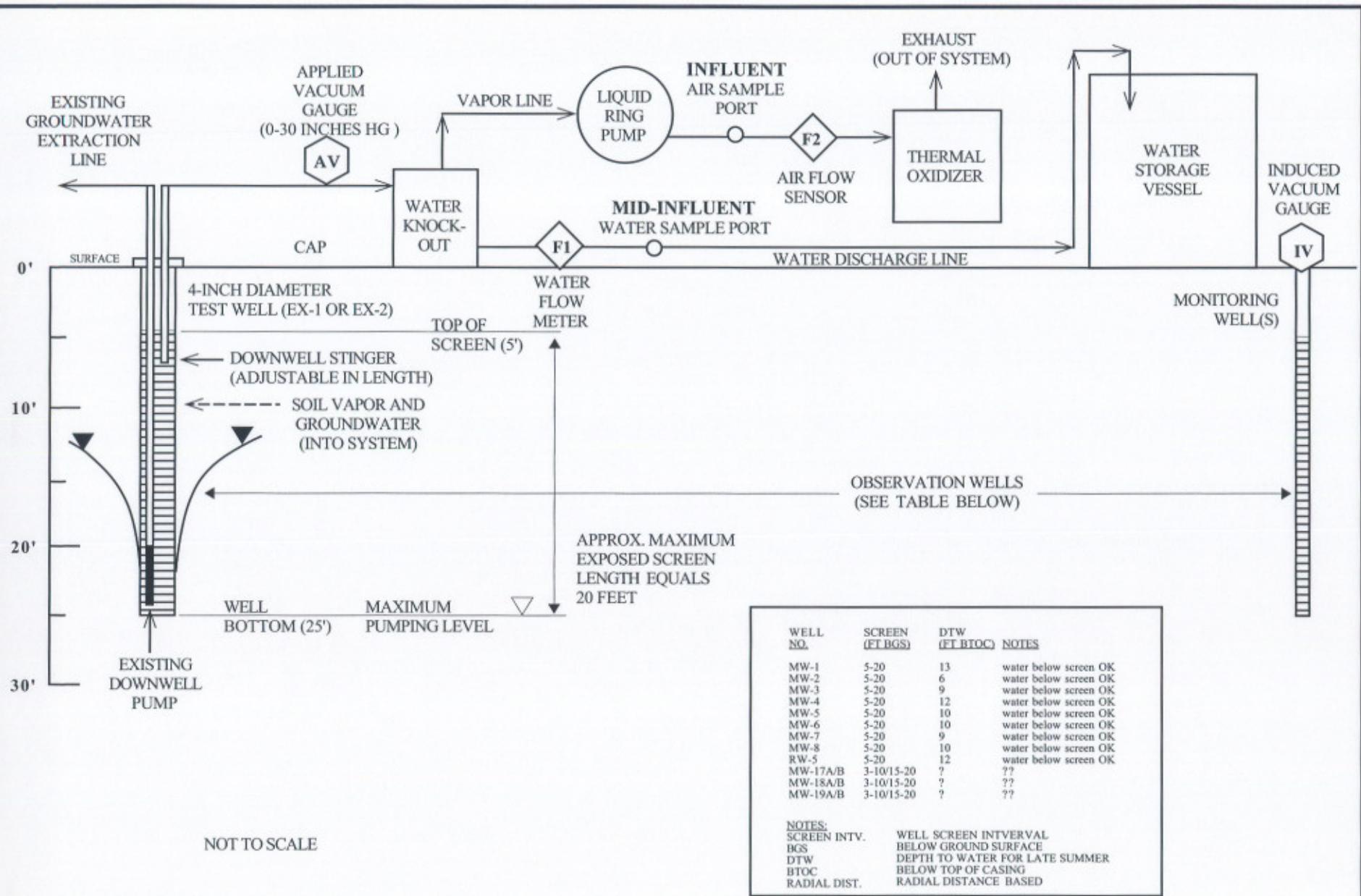
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Figure
7



High-Vacuum Dual-Phase Extraction Pilot Test Equipment Schematic

Fortuna Beacon Petro Mart
390 South Fortuna Blvd.
Fortuna, California

 BLUE ROCK ENVIRONMENTAL, INC.

Project No.
FNC-3

Report Date
8/05

Figure
8

Table 1
WELL CONSTRUCTION DETAILS
 Fortuna Beacon Petro Mart
 309 South Fortuna Boulevard
 Fortuna, California
 Blue Rock Project No. FNC-3

Well Identification	Date Installed	Installed by	Casing Diameter (inches)	Total Depth (feet)	Blank Interval (feet)	Screened Interval (feet)	Slot Size (inches)	Filter Pack (feet)	Bentonite Seal (feet)	Cement (feet)	First Encountered Groundwater (feet bgs)
MW-1	2/27/90	Laco	4	20	0-5	5-20	0.02	4-20	3-4	0-3	6
MW-2	2/27/90	Laco	4	20	0-5	5-20	0.02	4-20	3-4	0-3	6
MW-3	2/27/90	Laco	4	20	0-5	5-20	0.02	4-20	3-4	0-3	12
MW-4	6/30/92	Laco	4	20	0-5	5-20	0.02	4-20	3-4	0-3	16.5
MW-5	6/30/92	Laco	4	20	0-5	5-20	0.02	4-20	3-4	0-3	13.2
MW-6	7/1/92	Laco	4	20	0-5	5-20	0.02	4-20	3-4	0-3	15.5
MW-7	10/22/92	Laco	4	20	0-5	5-20	0.02	4-20	3-4	0-3	14
MW-8	10/21/92	Laco	4	20	0-5	5-20	0.02	4-20	3-4	0-3	13
MW-9*	10/21/92	Laco	4	20	0-5	5-20	0.02	4-20	3-4	0-3	18
MW-10	10/16/92	Laco	4	20	0-5	5-20	0.02	4-20	3-4	0-3	17
MW-11	10/19/02	Laco	4	20	0-5	5-20	0.02	4-20	3-4	0-3	18
MW-12	12/3/93	Laco	4	20	0-5	5-20	0.02	4-20	3-4	0-3	10
MW-13	12/6/93	Laco	4	20	0-5	5-20	0.02	4-20	3-4	0-3	5
MW-14	4/2/96	Clearwater	2	20	0-10	10-20	0.02	9-20	7-9	0-7	15
MW-15	7/21/98	Clearwater	2	20	0-10	10-20	0.02	9-20	7-9	0-7	15
MW-16	7/21/98	Clearwater	2	20	0-10	10-20	0.02	9-20	7-9	0-7	4.5
DW-1	4/3/96	Clearwater	2	40	0-30	30-40	0.02	27-40	25-27	0-27	18
DW-2	4/4/96	Clearwater	2	40.5	0-30	30-40.5	0.02	27-40.5	25-27	0-27	20
DW-3	4/4/96	Clearwater	2	40.5	0-30	30-40.5	0.02	27-40.5	25-27	0-27	15
RW-1*	10/23/00	Clearwater	4	20	0-5	5-20	0.01	4-20	3-4	0-3	10
RW-2*	10/23/00	Clearwater	4	20	0-5	5-20	0.01	4-20	3-4	0-3	5.5
RW-3*	10/23/00	Clearwater	4	20	0-5	5-20	0.01	4-20	3-4	0-3	5.5
RW-4B	10/23/00	Clearwater	4	20	0-5	5-20	0.01	4-20	3-4	0-3	3
RW-5	10/23/00	Clearwater	4	20	0-5	5-20	0.01	4-20	3-4	0-3	8

* : Destroyed by overdrilling and grouted with neat cement or removed during remedial soil excavation

TABLE 2
Soil Sample Analytical Data
 Fortuna Beacon Petro Mart
 390 South Fortuna Blvd.
 Fortuna, CA

Sample ID	Depth (ft bgs)	Sample Date	TPHg (mg/kg)	B (mg/kg)	T (mg/kg)	E (mg/kg)	X (mg/kg)	MTBE (mg/kg)
<i>Investigation Samples</i>								
MW-1	5	2/27/90	320	2.5	4.4	3.7	17	---
	10	2/27/90	<1	<0.05	0.10	<0.05	0.22	---
	15	2/27/90	51	3.1	3.0	0.72	4.0	---
	20	2/27/90	21	5.3	2.5	0.42	2.5	---
MW-2	5	2/28/90	<1	<0.05	<0.05	<0.05	<0.025	---
	10	2/28/90	<1	<0.05	<0.05	<0.05	<0.025	---
	15	2/28/90	<1	<0.05	<0.05	<0.05	0.10	---
	20	2/28/90	15	4.0	2.4	0.28	1.4	---
MW-3	5	3/1/90	14	<0.05	<0.05	<0.05	<0.025	---
	10	3/1/90	<1	<0.05	<0.05	<0.05	<0.025	---
	15	3/1/90	<1	<0.05	<0.05	<0.05	<0.025	---
	20	3/1/90	<1	<0.05	<0.05	<0.05	<0.025	---
MW-4	15	6/30/92	1.3	0.25	0.26	0.021	0.082	---
MW-5	15	6/30/92	130	0.39	0.80	1.1	7.1	---
MW-6	12.5	7/1/92	<1	<0.005	<0.005	<0.005	<0.005	---
	20	7/1/92	12	<0.005	0.15	0.11	0.76	---
MW-7	15	10/22/92	<1	<0.005	<0.005	<0.005	<0.005	---
MW-9	20	10/21/92	<1	<0.005	<0.005	<0.005	<0.005	---
MW-10	20	10/16/92	<1	<0.005	0.029	<0.005	<0.005	---
MW-11	20	10/19/92	<1	<0.005	<0.005	<0.005	<0.005	---
MW-12	15	12/3/93	<1	<0.005	<0.005	<0.005	<0.005	---
	15-20	12/3/93	3.6	<0.005	0.030	0.028	0.188	---
	20	12/3/93	<1	<0.005	<0.005	<0.005	<0.005	---
MW-13	10	12/6/93	<1	<0.005	<0.005	<0.005	<0.005	---
	15	12/6/93	<1	<0.005	<0.005	<0.005	<0.005	---
	20	12/6/93	<1	<0.005	<0.005	<0.005	<0.005	---
SW-1	6	7/11/91	<1	<0.005	<0.005	<0.005	<0.005	---
SW-2	12	7/11/91	420	0.27	2.0	2.3	9.7	---
SW-3	20	7/11/91	990	8.0	55	18	110	---
SW-4	6-8	7/11/91	<1	0.035	0.0069	<0.005	0.026	---
SW-5	7-9	7/11/91	130	0.39	3.5	1.4	9.4	---
SW-6	7-9	7/11/91	<1	<0.005	<0.005	<0.005	<0.005	---
	14	7/11/91	<1	<0.005	<0.005	<0.005	<0.005	---

TABLE 2
Soil Sample Analytical Data
 Fortuna Beacon Petro Mart
 390 South Fortuna Blvd.
 Fortuna, CA

Sample ID	Depth (ft bgs)	Sample Date	TPHg (mg/kg)	B (mg/kg)	T (mg/kg)	E (mg/kg)	X (mg/kg)	MTBE (mg/kg)
SW-7	7	7/11/91	<1	<0.005	<0.005	<0.005	<0.005	---
	12	7/11/91	<1	<0.005	<0.005	<0.005	<0.005	---
SW-8	7	7/11/91	<1	<0.005	<0.005	<0.005	<0.005	---
	12	7/11/91	<1	<0.005	<0.005	<0.005	<0.005	---
SW-9	7	7/11/91	<1	<0.005	<0.005	<0.005	<0.005	---
	11	7/11/91	<1	<0.005	<0.005	<0.005	<0.005	---
SW-10	8	7/11/91	<1	<0.005	<0.005	<0.005	<0.005	---
	13	7/11/91	<1	<0.005	<0.005	<0.005	<0.005	---
SW-11	11	3/20/92	26	0.68	1.1	0.32	1.9	---
SW-12	11	3/20/92	220	2.0	6.4	3.5	22	---
SW-13	11	3/19/92	3.6	<0.005	<0.10	<0.050	<0.050	---
SW-14	9	3/19/92	48	0.51	1.8	0.75	5.1	---
SW-15	11	3/20/92	<1	<0.005	<0.005	<0.005	<0.005	---
SW-16	9	4/28/92	<1	<0.005	<0.005	<0.005	<0.005	---
SW-17	9	4/28/92	<1	<0.005	<0.005	<0.005	<0.005	---
SW-18	6	4/28/92	<1	<0.005	<0.005	<0.005	<0.005	---
	9	4/28/92	<1	<0.005	<0.005	<0.005	<0.005	---
SW-19	9	4/28/92	<1	<0.005	<0.005	<0.005	<0.005	---
SW-20	9	4/28/92	<1	<0.005	<0.005	<0.005	<0.005	---
CPT-1	10	5/4/95	<1	<0.005	<0.005	<0.005	<0.005	---
CPT-2	10	5/4/95	<1	<0.005	<0.005	<0.005	<0.005	---
CPT-4	10	5/4/95	<1	0.008	0.020	<0.005	0.020	---
CPT-5	10	5/5/95	<1	<0.005	<0.005	<0.005	<0.005	---
CPT-6	10	5/5/95	<1	<0.005	<0.005	<0.005	<0.005	---
CPT-7	10	5/5/95	1.0	0.26	0.14	0.019	0.12	---
	15	5/5/95	2,300	19	100	35	20	---
CPT-8	15	5/5/95	<1	<0.005	<0.005	<0.005	<0.005	---

TABLE 2
Soil Sample Analytical Data
 Fortuna Beacon Petro Mart
 390 South Fortuna Blvd.
 Fortuna, CA

Sample ID	Depth (ft bgs)	Sample Date	TPHg (mg/kg)	B (mg/kg)	T (mg/kg)	E (mg/kg)	X (mg/kg)	MTBE (mg/kg)
DW-1	5	4/2/96	320	0.75	1.6	4.6	4.8	---
	10	4/2/96	0.3	0.14	<0.005	<0.005	0.011	---
	15	4/2/96	0.4	0.022	0.024	<0.005	0.026	---
	18	4/2/96	410	2.7	1.6	4.3	6.6	---
	21	4/3/96	530	<0.4	1.6	11	16	---
	24	4/3/96	0.3	0.006	<0.005	0.022	0.041	---
	25	4/3/96	0.4	0.024	<0.005	0.009	0.007	---
	28	4/3/96	<0.2	<0.005	<0.005	<0.005	<0.005	---
	30	4/3/96	<0.2	0.014	<0.005	<0.005	<0.005	---
	35	4/3/96	<0.2	<0.005	<0.005	<0.005	<0.005	---
DW-2	5	4/4/96	<0.2	<0.005	<0.005	<0.005	<0.005	---
	10	4/4/96	<0.2	<0.005	<0.005	<0.005	<0.005	---
	15	4/4/96	2.9	0.29	0.52	0.084	0.53	---
DW-3	5	4/4/96	<0.2	<0.005	<0.005	<0.005	<0.005	---
	10	4/4/96	<0.2	<0.005	<0.005	<0.005	<0.005	---
	15	4/4/96	450	<0.005	13	9.8	53	---
MW-14	5	4/2/96	<0.2	<0.005	<0.005	<0.005	<0.005	---
	10	4/2/96	<0.2	<0.005	<0.005	<0.005	<0.005	---
	16	4/2/96	<0.2	<0.005	<0.005	<0.005	<0.005	---
MW-15	6	7/21/98	<1	<0.005	<0.005	<0.005	<0.005	---
	11	7/21/98	<1	<0.005	<0.005	<0.005	<0.005	---
	15.5	7/21/98	<1	<0.005	<0.005	<0.005	<0.005	---
MW-16	6	7/21/98	<0.2	<0.005	<0.005	<0.005	<0.005	---
	11	7/21/98	<0.2	<0.005	<0.005	<0.005	<0.005	---
	16.5	7/21/98	450	<0.005	<0.005	<0.005	<0.005	---
HP-1	6	7/21/98	<1	<0.005	<0.005	<0.005	<0.005	---
	11	7/21/98	<1	<0.005	<0.005	<0.005	<0.005	---
	16	7/21/98	<1	<0.005	<0.005	<0.005	<0.005	---
RW-1	5	10/23/00	382	0.196	0.432	0.997	9.34	0.024
	15	10/23/00	0.117	0.006	<0.005	0.021	0.048	0.005
	20	10/23/00	61	1.37	4.75	1.31	7.81	0.066
RW-2	5	10/23/00	278	0.467	0.122	4.61	9.62	0.015
	15	10/23/00	559	0.235	1.22	1.27	3.6	0.75
	20	10/23/00	5,760	14.9	250	55.3	477	<0.5
RW-3	5	10/24/00	765	1.66	15.7	9.5	73.8	<0.005
	15	10/24/00	113	0.114	0.167	2.47	5.25	0.024
	20	10/24/00	0.984	0.112	0.075	0.231	0.467	0.047
RW-4	10	10/24/00	<0.060	<0.005	<0.005	<0.005	<0.015	<0.005
	20	10/24/00	<0.060	0.058	<0.005	<0.005	<0.015	<0.005

TABLE 2
Soil Sample Analytical Data
 Fortuna Beacon Petro Mart
 390 South Fortuna Blvd.
 Fortuna, CA

Sample ID	Depth (ft bgs)	Sample Date	TPHg (mg/kg)	B (mg/kg)	T (mg/kg)	E (mg/kg)	X (mg/kg)	MTBE (mg/kg)
RW-4B	5	10/24/00	0.717	<0.025	0.246	0.071	0.422	<0.025
	10	10/24/00	0.237	0.033	0.119	0.079	0.509	<0.005
	15	10/24/00	484	0.998	19.3	7.32	43.7	<0.50
	20	10/24/00	7.89	0.115	0.853	0.185	1.01	<0.025
RW-5	10	10/25/00	7.33	0.241	0.405	0.087	0.508	<0.50
	15	10/25/00	115	0.536	3.4	1.54	8.6	<0.50
	20	10/25/00	2,280	6.63	123	40.1	219	<0.50

Remedial Excavation (EX-1) Sidewall Samples

W-SW@7	7	8/2/01	1,000	<0.25	<0.25	4.7	8.8	<0.25
E-SW@7	7	8/2/01	280	0.28	3.5	2.9	21	<0.05
NW-SW@7	7	8/2/01	<1	0.032	0.0054	0.0064	0.02	<0.005
NE-SW@7	7	8/2/01	630	0.53	0.33	7.9	16	<0.25
SW-SW@7	7	8/2/01	<1	<0.01	<0.01	<0.01	<0.01	<0.01
SE-SW@7	7	8/2/01	50	0.027	0.02	0.42	1.2	0.014

Notes:

ft bgs

Feet below ground surface

mg/kg

Milligrams per kilogram

TPHg

Total petroleum hydrocarbons as gasoline by EPA Method 8015M or 8260B

BTEX

Benzene, toluene, ethylbenzene, and xylenes by EPA Method 8020 or 8260B

MTBE

Methyl tert-butyl ether by EPA Method 8020 or 8260B

Not tested, not available

Table 3
GROUNDWATER ELEVATIONS AND
ANALYTICAL RESULTS
 Fortuna Beacon Petro Mart
 390 South Fortuna Boulevard
 Fortuna, California
 Blue Rock Project # FNC-3

Well No.	Sampling Date	TOC (feet)	DTW (feet)	*LNAPL (feet)	GWE (feet)	TPHg (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	MTBE (µg/L)
MW-1	4/5/90	54.63	---	---	---	220,000	2,500	6,700	3,500	19,000	---
	4/9/90	54.63	7.00	0.01	47.64	---	---	---	---	---	---
Screen	5/12/90	54.63	10.84	0.00	43.79	---	---	---	---	---	---
5'-20'	7/26/90	54.63	---	---	---	87,000	3,600	4,400	4,400	13,000	---
	9/27/90	54.63	17.60	3.60	39.91	---	---	---	---	---	---
	10/23/90	54.63	17.39	3.80	40.28	---	---	---	---	---	---
	11/14/90	54.63	11.63	2.85	45.28	---	---	---	---	---	---
	12/14/90	54.63	12.70	2.87	44.23	---	---	---	---	---	---
	1/11/91	54.63	13.61	2.84	43.29	---	---	---	---	---	---
	2/28/91	54.63	11.30	2.45	45.29	---	---	---	---	---	---
	3/19/91	54.63	9.02	2.75	47.81	---	---	---	---	---	---
	4/16/91	54.63	9.73	3.06	47.35	---	---	---	---	---	---
	6/20/91	54.63	12.95	2.25	43.48	---	---	---	---	---	---
	7/24/91	54.63	14.05	2.11	42.27	---	---	---	---	---	---
	11/21/91	Skimmer activated		---	---	---	---	---	---	---	---
	1/22/92	54.63	13.16	0.00	41.47	---	---	---	---	---	---
	4/7/92	54.63	9.97	0.00	44.66	---	---	---	---	---	---
	5/4/92	54.63	10.50	0.14	44.24	---	---	---	---	---	---
	6/4/92	54.63	12.96	0.09	41.74	---	---	---	---	---	---
	7/10/92	54.63	14.22	0.05	40.45	---	---	---	---	---	---
	8/5/92	54.63	15.71	0.09	38.99	---	---	---	---	---	---
	10/28/92	54.63	17.03	0.00	37.60	---	---	---	---	---	---
	1/12/93	54.63	12.10	0.00	42.53	---	---	---	---	---	---
	2/4/93	54.63	11.40	0.00	43.23	---	---	---	---	---	---
	5/5/93	54.63	10.40	0.00	44.23	---	---	---	---	---	---
	8/30/93	54.63	15.03	0.08	39.66	---	---	---	---	---	---
	9/14/93	54.63	15.08	0.08	39.61	---	---	---	---	---	---
	10/12/93	54.63	15.51	0.00	39.12	---	---	---	---	---	---
	11/29/93	54.63	16.03	0.00	38.60	---	---	---	---	---	---
	12/21/93	54.63	11.97	0.00	42.66	---	---	---	---	---	---
	1/12/94	54.63	10.08	0.00	44.55	---	---	---	---	---	---
	2/22/94	54.63	7.39	0.00	47.24	---	---	---	---	---	---
	3/24/94	54.63	8.97	0.00	45.66	---	---	---	---	---	---
	4/26/94	54.63	9.43	0.00	45.20	---	---	---	---	---	---
	5/18/94	54.63	10.64	0.00	43.99	---	---	---	---	---	---
	6/20/94	54.63	12.88	0.00	41.75	---	---	---	---	---	---
	9/27/94	54.63	16.18	0.00	38.45	---	---	---	---	---	---
	10/19/94	54.63	16.27	0.00	38.36	---	---	---	---	---	---
	12/23/94	54.63	8.73	0.00	45.90	---	---	---	---	---	---
	3/25/95	54.63	6.62	0.00	48.01	---	---	---	---	---	---
	4/15/96	54.63	6.62	0.00	48.01	11,000	130	10	260	310	3,000
	2/24/97	54.63	5.71	0.00	48.92	6,600	88	<13	150	262	1,200
	5/26/97	54.63	7.41	0.00	47.22	9,600	100	<20	250	360	1,000
	9/5/97	54.63	13.36	0.00	41.27	7,100	13	<20	56	77	190
	12/11/97	54.63	8.40	0.00	46.23	5,100	80	<2.5	22	122	1,900
	4/9/98	54.63	5.49	0.00	49.14	4,000	90	3	120	100	180
	6/22/98	54.63	3.40	0.00	51.23	9,000	140	210	170	391	<250
	9/26/98	54.63	12.72	0.00	41.91	670	4	<0.5	2.6	6.6	160
	1/14/99	54.63	5.93	0.00	48.70	13,000	170	<80	220	435	550
	3/30/99	54.63	5.11	0.00	49.52	95	3.9	<0.5	1.50	1.7	12*
	6/28/99	54.63	9.37	0.00	45.23	9,700	95	24	140	273	120
	10/5/99	54.63	12.57	0.00	42.06	6,200	100	<20	92	175	120
	12/10/99	54.63	10.97	0.00	43.66	7,900	99	<30	63	100	78
	3/23/00	54.63	5.57	0.00	49.06	3,800	79	<40	63	85	33
	6/7/00	54.63	8.02	0.00	46.61	2,160	45	<3.0	48	129	<20 *
	9/14/00	54.63	13.13	0.00	41.50	5,140	251	<3.0	67.5	126	32.3*
	11/29/00	54.63	11.96	0.00	42.67	7,470	44	<30	31	80	<200*

Table 3
GROUNDWATER ELEVATIONS AND
ANALYTICAL RESULTS
 Fortuna Beacon Petro Mart
 390 South Fortuna Boulevard
 Fortuna, California
 Blue Rock Project # FNC-3

Well No.	Sampling Date	TOC (feet)	DTW (feet)	*LNAPL (feet)	GWE (feet)	TPHg (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	MTBE (µg/L)
MW-1	3/21/01	54.63	11.09	0.00	43.54	4,690	42.4	1.5	50.6	133	69.1*
	6/5/01	54.63	12.42	0.00	42.21	5,700	65	1.3	38	110	110*
Screen	9/6/01	54.63	14.98	0.00	39.65	6,100	120	390	51	210	81*
5'-20'	12/11/01	54.63	11.98	0.00	42.65	7,200	230	640	130	520	230*
	3/12/02	54.63	10.18	0.00	44.45	9,800	220	610	180	660	170*
	6/11/02	54.63	12.12	0.00	42.51	4,800	170	100	67	190	340*
	9/9/02	57.77	15.63	0.00	42.14	4,900	130	28	33	81	280*
	12/20/02	57.77	14.11	0.00	43.66	4,600	95	52	46	170	230*
	3/12/03	57.77	11.51	0.00	46.26	6,100	85	110	87	320	200*
	6/6/03	57.77	11.25	0.00	46.52	4,400	120	20	31	81	180*
	9/17/03	57.77	15.34	0.00	42.43	4,600	170	28	40	79	210*
	12/5/03	57.77	14.22	0.00	43.55	4,000	140	27	43	97	240*
	3/15/04	57.77	9.84	0.00	47.93	4,700	100	23	46	100	140*
	6/9/04	57.77	12.20	0.00	45.57	4,400	240	24	32	59	180*
	9/13/04	57.77	14.54	0.00	43.23	3,800	240	32	33	55	200*
	12/10/04	57.77	12.97	0.00	44.80	5,400	640	47	36	66	150*
	3/24/05	57.77	13.70	0.00	44.07	11,000	2,600	60	42	70	110*
	6/1/05	57.77	13.71	0.00	44.06	13,000	4,600	140	64	92	160*
MW-2	4/5/90	55.63	---	---	860,000	4,200	18,000	7,100	47,000	---	---
	4/9/90	55.63	7.19	0.55	48.88	---	---	---	---	---	---
Screen	5/12/90	55.63	9.22	0.15	46.53	---	---	---	---	---	---
5'-20'	7/26/90	55.63	---	---	---	81,000	<500	2,600	1,400	13,000	---
	9/27/90	55.63	17.80	2.85	40.11	---	---	---	---	---	---
	10/23/90	55.63	18.64	3.90	40.11	---	---	---	---	---	---
	11/14/90	55.63	13.35	3.92	45.42	---	---	---	---	---	---
	12/14/90	55.63	10.15	2.79	47.71	---	---	---	---	---	---
	1/11/91	55.63	11.01	2.79	46.85	---	---	---	---	---	---
	2/28/91	55.63	7.15	0.75	49.08	---	---	---	---	---	---
	3/19/91	55.63	5.62	0.37	50.31	---	---	---	---	---	---
	4/16/91	55.63	6.34	0.49	49.68	---	---	---	---	---	---
	6/20/91	55.63	7.54	0.61	48.58	---	---	---	---	---	---
	7/24/91	55.63	8.00	0.99	48.42	---	---	---	---	---	---
	11/21/91	Skimmer activated		---	---	---	---	---	---	---	---
	1/22/92	55.63	6.61	0.05	49.06	---	---	---	---	---	---
	4/7/92	55.63	6.27	0.00	49.36	---	---	---	---	---	---
	5/4/92	55.63	6.50	0.23	49.31	---	---	---	---	---	---
	6/4/92	55.63	7.16	0.12	48.57	---	---	---	---	---	---
	7/10/92	55.63	11.50	4.08	47.39	---	---	---	---	---	---
	8/5/92	55.63	9.33	0.13	46.40	---	---	---	---	---	---
	10/28/92	55.63	7.75	0.28	48.10	---	---	---	---	---	---
	1/12/93	55.63	5.40	0.00	50.23	---	---	---	---	---	---
	2/4/93	55.63	5.78	0.00	49.85	---	---	---	---	---	---
	5/5/93	55.63	5.80	0.00	49.83	---	---	---	---	---	---
	8/30/93	55.63	13.61	0.03	42.04	---	---	---	---	---	---
	9/14/93	55.63	13.59	0.03	42.06	---	---	---	---	---	---
	10/12/93	55.63	15.84	0.00	39.79	---	---	---	---	---	---
	11/29/93	55.63	7.34	0.02	48.31	---	---	---	---	---	---
	12/21/93	55.63	5.99	0.00	49.64	---	---	---	---	---	---
	1/12/94	55.63	5.83	0.00	49.80	---	---	---	---	---	---
	2/22/94	55.63	4.84	0.00	50.79	---	---	---	---	---	---
	3/24/94	55.63	5.66	0.00	49.97	---	---	---	---	---	---
	4/26/94	55.63	5.62	0.00	50.01	---	---	---	---	---	---
	10/19/94	55.63	12.50	0.01	43.14	---	---	---	---	---	---
	11/23/94	55.63	6.18	0.00	49.45	---	---	---	---	---	---
	12/23/94	55.63	5.89	0.00	49.74	---	---	---	---	---	---
	1/25/95	55.63	5.23	0.00	50.40	---	---	---	---	---	---

Table 3
GROUNDWATER ELEVATIONS AND
ANALYTICAL RESULTS
 Fortuna Beacon Petro Mart
 390 South Fortuna Boulevard
 Fortuna, California
 Blue Rock Project # FNC-3

Well No.	Sampling Date	TOC (feet)	DTW (feet)	*LNAPL (feet)	GWE (feet)	TPHg ($\mu\text{g/L}$)	Benzene ($\mu\text{g/L}$)	Toluene ($\mu\text{g/L}$)	Ethylbenzene ($\mu\text{g/L}$)	Xylenes ($\mu\text{g/L}$)	MTBE ($\mu\text{g/L}$)
MW-2	2/23/95	55.63	6.09	0.00	49.54	---	---	---	---	---	---
	3/25/95	55.63	5.01	0.00	50.62	---	---	---	---	---	---
Screen	4/15/96	55.63	6.00	0.00	49.63	<50	<0.5	<0.5	<0.5	<2.0	<5.0
5'-20'	2/24/97	55.63	5.48	0.00	50.15	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	5/26/97	55.63	6.78	0.00	48.85	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	9/5/97	55.63	7.61	0.00	48.02	<50	<0.5	<0.5	<0.5	<0.5	31
	12/11/97	55.63	5.37	0.00	50.26	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	4/9/98	55.63	5.36	0.00	50.27	210	18	44	6	26	<5.0
	6/22/98	55.63	7.46	0.00	48.17	540	8	52	18	87	<5.0
	9/26/98	55.63	8.88	0.00	46.75	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	1/14/99	55.63	6.17	0.00	49.46	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	3/30/99	55.63	5.05	0.00	50.58	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	6/28/99	55.63	6.82	0.00	48.81	<50	<0.5	<0.5	<0.5	<0.5	<3.0
	10/5/99	55.63	6.34	0.00	49.29	<50	<0.5	<0.5	<0.5	<1.0	<3.0
	12/10/99	55.63	5.13	0.00	50.50	<50	<0.5	<0.5	<0.5	<1.0	<3.0
	3/23/00	55.63	5.69	0.00	49.94	<50	<0.5	<0.5	<0.5	<1.0	<3.0
	6/7/00	55.63	5.86	0.00	49.77	<50	<0.3	<0.3	<0.3	<0.6	<2.0 *
	9/14/00	55.63	5.80	0.00	49.83	53	1.2	4.5	1.0	5.5	<2.0 *
	11/29/00	55.63	5.72	0.00	49.91	<50	<0.3	<0.3	<0.3	<0.6	<2.0 *
	3/21/01	55.63	5.98	0.00	49.65	<50	<0.3	<0.3	<0.3	<0.6	<2.0 *
	6/5/01	55.63	6.28	0.00	49.35	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	9/6/01	55.63	7.07	0.00	48.56	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	12/11/01	55.63	5.28	0.00	50.35	---	---	---	---	---	---
	3/12/02	55.63	5.61	0.00	50.02	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	6/11/02	55.63	6.25	0.00	49.38	---	---	---	---	---	---
	9/9/02	58.79	6.67	0.00	52.12	---	---	---	---	---	---
	12/20/02	58.79	4.71	0.00	54.08	---	---	---	---	---	---
	3/12/03	58.79	6.01	0.00	52.78	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	6/6/03	58.79	6.05	0.00	52.74	---	---	---	---	---	---
	9/17/03	58.79	7.57	0.00	51.22	---	---	---	---	---	---
	12/5/03	58.79	6.68	0.00	52.11	---	---	---	---	---	---
	3/15/04	58.79	5.83	0.00	52.96	<50	<0.5	<0.5	<0.5	<0.5	<0.5
	6/9/04	58.79	6.57	0.00	52.22	---	---	---	---	---	---
	9/13/04	58.79	6.82	0.00	51.97	---	---	---	---	---	---
	12/10/04	58.79	5.28	0.00	53.51	---	---	---	---	---	---
	3/24/05	58.79	5.34	0.00	53.45	<50	<0.5	<0.5	<0.5	<0.5	<0.5
	6/1/05	58.79	6.05	0.00	52.74	---	---	---	---	---	---
MW-3	4/5/90	55.49	---	---	---	<50	<1.0	<1.0	<1.0	4.3	---
	4/9/90	55.49	11.93	---	43.56	---	---	---	---	---	---
Screen	5/12/90	55.49	12.82	---	42.67	---	---	---	---	---	---
5'-20'	7/26/90	55.49	---	---	---	<50	<1.0	<1.0	<1.0	0.94	---
	9/27/90	55.49	14.91	---	40.58	---	---	---	---	---	---
	10/23/90	55.49	14.70	---	40.79	---	---	---	---	---	---
	11/14/90	55.49	14.38	---	41.11	<50	<0.5	<0.5	<0.5	<0.5	---
	12/14/90	55.49	13.95	---	41.54	---	---	---	---	---	---
	1/11/91	55.49	14.85	---	40.64	---	---	---	---	---	---
	2/28/91	55.49	13.66	---	41.83	<50	<0.5	<0.5	<0.5	<0.5	---
	3/19/91	55.49	11.92	---	43.57	---	---	---	---	---	---
	4/16/91	55.49	11.04	---	44.45	---	---	---	---	---	---
	5/24/91	55.49	---	---	<50	<0.5	<0.5	<0.5	<0.5	<0.5	---
	6/20/91	55.49	11.55	---	43.94	---	---	---	---	---	---
	7/24/91	55.49	11.74	---	43.75	---	---	---	---	---	---
	1/22/92	55.49	13.28	---	42.21	---	---	---	---	---	---
	4/7/92	55.49	11.53	---	43.96	---	---	---	---	---	---
	5/4/92	55.49	11.17	---	44.32	---	---	---	---	---	---
	6/4/92	55.49	12.68	---	42.81	---	---	---	---	---	---

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Well No.	Sampling Date	TOC (feet)	DTW (feet)	*LNAPL (feet)	GWE (feet)	TPHg (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	MTBE (µg/L)
MW-3	7/10/92	55.49	13.62	---	41.87	---	---	---	---	---	---
	8/5/92	55.49	14.14	---	41.35	---	---	---	---	---	---
Screen	10/28/92	55.49	16.56	---	38.93	---	---	---	---	---	---
5'-20'	11/2/92	55.49	---	---	---	<50	<0.5	<0.5	<0.5	<0.5	---
	1/12/93	55.49	13.09	---	42.40	---	---	---	---	---	---
	2/4/93	55.49	12.19	---	43.30	---	---	---	---	---	---
	3/2/93	55.49	11.06	---	44.43	<50	<0.5	1.4	<0.5	0.60	---
	5/5/93	55.49	10.59	---	44.90	---	---	---	---	---	---
	8/30/93	55.49	14.49	---	41.00	<50	<0.5	<0.5	<0.5	<0.5	---
	12/16/93	55.49	---	---	---	<50	<0.5	<0.5	<0.5	<0.5	---
	12/21/93	55.49	14.81	---	40.68	---	---	---	---	---	---
	3/24/94	55.49	12.53	---	42.96	---	---	---	---	---	---
	4/26/94	55.49	12.71	---	42.78	---	---	---	---	---	---
	6/20/94	55.49	13.78	---	41.71	<50	<0.5	<0.5	<0.5	<0.5	---
	9/27/94	55.49	16.68	---	38.81	---	---	---	---	---	---
	10/19/94	55.49	16.88	---	38.61	---	---	---	---	---	---
	11/23/94	55.49	15.65	---	39.84	---	---	---	---	---	---
	12/23/94	55.49	14.09	---	41.40	---	---	---	---	---	---
	1/25/95	55.49	11.66	---	43.83	---	---	---	---	---	---
	2/23/95	55.49	11.61	---	43.88	---	---	---	---	---	---
	3/25/95	55.49	9.84	---	45.65	---	---	---	---	---	---
	4/15/96	55.49	10.40	---	45.09	<1,000	<10	<10	<10	<40	12,000
	2/24/97	55.49	9.85	---	45.64	<50	<0.5	<0.5	<0.5	<0.5	510
	5/25/97	55.49	11.44	---	44.05	110	<0.5	<0.5	<0.5	<0.5	530
	9/5/97	55.49	13.32	---	42.17	360	<0.5	<0.5	<0.5	<0.5	2,000
	12/11/97	55.49	12.26	---	43.23	---	---	---	---	---	---
	4/8/98	55.49	7.80	---	47.69	60	7.1	14	1.2	5	240
	6/22/98	55.49	NM	---	---	---	---	---	---	---	---
	9/26/98	55.49	NM	---	---	---	---	---	---	---	---
	1/14/99	55.49	11.05	---	44.44	---	---	---	---	---	---
	3/30/99	55.49	7.46	---	48.03	<50	<0.5	<0.5	<0.5	<0.5	9.8*
	6/28/99	55.49	--	---	---	---	---	---	---	---	---
	10/5/99	55.49	11.65	---	43.84	---	---	---	---	---	---
	12/10/99	55.49	10.99	---	44.50	---	---	---	---	---	---
	3/23/00	55.49	8.48	---	47.01	<50	<0.5	<0.5	<0.5	<1.0	1.9*
	6/7/00	55.49	9.72	---	45.77	---	---	---	---	---	---
	9/14/00	55.49	10.86	---	44.63	53	0.7	2.9	0.7	3.2	16.4*
	11/29/00	55.49	10.68	---	44.81	<50	<0.3	<0.3	<0.3	<0.6	52.2*
	3/21/01	55.49	9.49	---	46.00	<50	<0.3	<0.3	<0.3	<0.6	<2.0*
	6/5/01	55.49	10.29	---	45.20	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	9/6/01	55.49	12.38	---	43.11	<50	<0.5	<0.5	<0.5	<0.5	1.2*
	12/11/01	55.49	10.15	---	45.34	---	---	---	---	---	---
	3/12/02	55.49	5.64	---	49.85	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	6/11/02	55.49	10.28	---	45.21	---	---	---	---	---	---
	9/9/02	58.62	11.79	---	46.83	---	---	---	---	---	---
	12/20/02	58.62	10.62	---	48.00	---	---	---	---	---	---
	3/12/03	58.62	9.28	---	49.34	<50	6.1	<0.5	<0.5	2.8	70*
	6/6/03	58.62	9.28	---	49.34	---	---	---	---	---	---
	9/17/03	58.62	11.82	---	46.80	---	---	---	---	---	---
	12/5/03	58.62	11.79	---	46.83	---	---	---	---	---	---
	3/15/04	58.62	8.59	---	50.03	<50	<0.5	<0.5	<0.5	<0.5	12*
	6/9/04	58.62	10.28	---	48.34	---	---	---	---	---	---
	9/13/04	58.62	11.89	---	46.73	---	---	---	---	---	---
	12/10/04	58.62	10.39	---	48.23	---	---	---	---	---	---
	3/24/05	58.62	9.00	---	49.62	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	6/1/05	58.62	9.23	---	49.39	---	---	---	---	---	---

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Well No.	Sampling Date	TOC (feet)	DTW (feet)	*LNAPL (feet)	GWE (feet)	TPHg (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	MTBE (µg/L)
MW-4	11/21/91	Skimmer activated				---	---	---	---	---	---
	7/13/92	55.03	---	---	---	71,000	320	4,300	1,200	7,100	---
Screen	10/28/92	55.03	18.32	1.89	38.22	---	---	---	---	---	---
5'-20'	11/9/92	55.03	---	(16.25)	---	---	---	---	---	---	---
	1/12/93	55.03	16.69	3.35	41.02	---	---	---	---	---	---
	2/4/93	55.03	14.82	2.46	42.18	---	---	---	---	---	---
	5/5/93	55.03	13.43	2.06	43.25	---	---	---	---	---	---
	5/10/93	55.03	10.81	0.03	44.24	---	---	---	---	---	---
	5/27/93	55.03	12.36	0.09	42.74	---	---	---	---	---	---
	8/30/93	55.03	15.15	0.32	40.14	---	---	---	---	---	---
	9/14/93	55.03	15.60	0.54	39.86	---	---	---	---	---	---
	10/12/93	55.03	15.80	0.00	39.23	---	---	---	---	---	---
	11/29/93	55.03	17.66	0.00	37.37	---	---	---	---	---	---
	12/21/93	55.03	15.08	0.01	39.96	---	---	---	---	---	---
	1/12/94	55.03	14.71	0.00	40.32	---	---	---	---	---	---
	2/22/94	55.03	14.71	0.00	40.32	---	---	---	---	---	---
	3/24/94	55.03	12.91	0.00	42.12	---	---	---	---	---	---
	4/26/94	55.03	12.79	0.00	42.24	---	---	---	---	---	---
	5/18/94	55.03	12.77	0.00	42.26	---	---	---	---	---	---
	6/20/94	55.03	13.77	0.04	41.29	---	---	---	---	---	---
	10/19/94	55.03	16.66	0.12	38.47	---	---	---	---	---	---
	11/23/94	55.03	16.01	0.35	39.30	---	---	---	---	---	---
	12/23/94	55.03	14.62	0.26	40.62	---	---	---	---	---	---
	1/25/95	55.03	12.19	0.05	42.88	---	---	---	---	---	---
	2/23/95	55.03	11.81	0.09	43.29	---	---	---	---	---	---
	3/25/95	55.03	10.55	0.00	44.48	---	---	---	---	---	---
	4/15/96	55.03	11.60	0.55	43.87	---	---	---	---	---	---
	2/24/97	55.03	11.00	0.02	44.05	100,000	3,700	13,000	2,200	14,200	<5,000
	5/26/97	55.03	11.55	0.05	43.52	---	---	---	---	---	---
	9/5/97	55.03	---	0.04	---	---	---	---	---	---	---
	12/11/97	55.03	13.33	0.01	41.71	190,000	5,300	16,000	2,900	16,900	<5,000
	4/8/98	55.03	9.40	0.03	45.65	---	---	---	---	---	---
	6/22/98	55.03	11.71	0.00	43.32	140,000	6,100	15,000	3,000	15,200	1,500
	9/26/98	55.03	14.10	HvySheen	40.93	120,000	6,800	19,000	4,100	16,000	2,400
	1/14/99	55.03	11.62	0.00	43.41	91,000	5,800	20,000	3,000	20,200	*190
	3/30/99	55.03	8.75	0.00	46.28	66,000	3,400	13,000	1,900	13,000	<40
	6/28/99	55.03	12.11	0.02	42.94	---	---	---	---	---	---
	10/5/99	55.03	---	0.08	---	---	---	---	---	---	---
	12/10/99	55.03	---	0.20	---	---	---	---	---	---	---
	3/23/00	55.03	9.85	0.00	45.18	200,000	7,900	20,000	3,300	17,400	<3,000
	6/7/00	55.03	11.81	0.00	43.22	87,900	4,500	10,900	2,470	10,500	579 *
	9/14/00	55.03	13.86	0.00	41.17	173,000	8,250	16,000	6,810	23,400	910*
	11/29/00	55.03	13.36	0.00	41.67	216,000	6,610	16,200	7,370	26,800	<2,000*
	3/21/01	55.03	11.17	0.00	43.86	53,900	3,360	8,460	2,520	8,610	244*
	6/5/01	55.03	12.44	0.00	42.59	85,000	4,600	11,000	3,000	11,000	400*
	9/6/01	55.03	14.94	0.00	40.09	110,000	4,700	13,000	3,200	12,000	360*
	12/11/01	55.03	12.07	0.00	42.96	110,000	5,200	14,000	3,300	15,000	400*
	3/12/02	55.03	10.3	0.00	44.73	75,000	4,700	14,000	2,800	13,000	190*
	6/11/02	55.03	12.16	0.00	42.87	110,000	4,700	16,000	3,300	15,000	150*
	9/9/02	58.18	14.99	0.00	43.19	82,000	4,700	11,000	3,300	11,000	350*
	12/20/02	58.18	13.79	0.00	44.39	94,000	5,100	14,000	3,400	14,000	240*
	3/12/03	58.18	11.42	0.00	46.76	100,000	3,700	18,000	3,100	16,000	<100*
	6/6/03	58.18	11.20	0.00	46.98	120,000	2,400	19,000	2,900	18,000	<50*
	9/17/03	58.18	15.26	0.00	42.92	96,000	2,800	14,000	3,100	16,000	<25*
	12/5/03	58.18	14.41	0.00	43.77	83,000	3,000	12,000	3,000	14,000	<50*
	3/15/04	58.18	9.96	0.00	48.22	81,000	1,500	11,000	1,900	12,000	<25*
	6/9/04	58.18	12.24	0.00	45.94	110,000	1,600	16,000	2,900	17,000	<50*

Table 3
GROUNDWATER ELEVATIONS AND
ANALYTICAL RESULTS
 Fortuna Beacon Petro Mart
 390 South Fortuna Boulevard
 Fortuna, California
 Blue Rock Project # FNC-3

Well No.	Sampling Date	TOC (feet)	DTW (feet)	*LNAPL (feet)	GWE (feet)	TPHg (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	MTBE (µg/L)
MW-4	9/13/04	58.18	14.63	0.00	43.55	92,000	2,200	12,000	3,200	17,000	<50*
	12/10/04	58.18	13.25	0.00	44.93	79,000	1,500	8,700	2,200	11,000	<20*
Screen	3/24/05	58.18	12.22	0.00	45.96	79,000	1,700	6,900	2,200	11,000	36*
5'-20'	6/1/05	58.18	12.11	0.00	46.07	77,000	1,800	6,800	2,800	10,000	46*
MW-5	11/21/91	Skimmer activated				---	---	---	---	---	---
	7/13/92	53.41	---	---	---	44,000	270	3,700	850	5,500	---
Screen	9/2/92	53.41	17.14	2.19	38.02	---	---	---	---	---	---
5'-20'	10/28/92	53.41	17.13	1.91	37.81	---	---	---	---	---	---
	11/9/92	53.41	---	(14.98)	---	---	---	---	---	---	---
	2/4/93	53.41	13.25	1.43	41.30	---	---	---	---	---	---
	5/5/93	53.41	11.40	0.72	42.59	---	---	---	---	---	---
	5/10/93	53.41	11.82	1.17	42.53	---	---	---	---	---	---
	5/27/93	53.41	11.58	0.02	41.85	---	---	---	---	---	---
	8/30/93	53.41	13.12	0.00	40.29	---	---	---	---	---	---
	9/14/93	53.41	13.21	0.00	40.20	---	---	---	---	---	---
	10/12/93	53.41	13.82	0.11	39.68	---	---	---	---	---	---
	12/21/93	53.41	13.31	0.01	40.11	---	---	---	---	---	---
	2/22/94	53.41	10.97	0.00	42.44	---	---	---	---	---	---
	3/24/94	53.41	10.69	0.00	42.72	---	---	---	---	---	---
	4/26/94	53.41	11.34	0.10	42.15	---	---	---	---	---	---
	5/18/94	53.41	11.09	0.00	42.32	---	---	---	---	---	---
	6/20/94	53.41	11.90	0.00	41.51	---	---	---	---	---	---
	9/27/94	53.41	14.98	0.00	38.43	---	---	---	---	---	---
	10/19/94	53.41	14.77	0.03	38.66	---	---	---	---	---	---
	11/23/94	53.41	14.11	0.00	39.30	---	---	---	---	---	---
	12/23/94	53.41	12.63	0.00	40.78	---	---	---	---	---	---
	1/25/95	53.41	10.63	0.00	42.78	---	---	---	---	---	---
	2/23/95	53.41	10.12	0.00	43.29	---	---	---	---	---	---
	3/25/95	53.41	8.74	0.00	44.67	---	---	---	---	---	---
	4/15/96	53.41	9.18	0.00	44.23	1,900	3.1	0.8	9.2	64	<50
	2/24/97	53.41	8.80	0.00	44.61	2,200	<4.0	10	<4.0	5.1	25
	5/26/97	53.41	10.82	0.00	42.59	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	9/5/97	53.41	12.38	0.00	41.03	56	<0.5	<0.5	<0.5	<0.5	<5.0
	12/11/97	53.41	12.62	0.00	40.79	---	---	---	---	---	---
	4/9/98	53.41	8.68	0.00	44.73	130	16	41	4.6	22	<5.0
	6/22/98	53.41	9.31	0.00	44.10	---	---	---	---	---	---
	9/26/98	53.41	13.20	0.00	40.21	---	---	---	---	---	---
	1/14/99	53.41	11.89	0.00	41.52	---	---	---	---	---	---
	3/30/99	53.41	7.35	0.00	46.06	<50	<0.5	0.65	<0.5	<0.5	<3.0
	6/28/99	53.41	11.04	0.00	42.37	---	---	---	---	---	---
	10/5/99	53.41	13.16	0.00	40.25	---	---	---	---	---	---
	12/10/99	53.41	11.84	0.00	41.57	---	---	---	---	---	---
	3/24/00	53.41	8.21	0.00	45.20	1,200	<4.0	<40	<2.0	<4.0	7.6
	6/7/00	53.41	10.71	0.00	42.70	---	---	---	---	---	---
	9/15/00	53.41	12.85	0.00	40.56	447	<0.3	1.3	0.8	3.0	5.6*
	11/29/00	53.41	12.23	0.00	41.18	833	<3.0	<0.3	<0.3	<0.6	10.2*
	3/21/01	53.41	10.13	0.00	43.28	1,110	<0.3	<0.3	<0.3	<0.6	5*
	6/5/01	53.41	11.41	0.00	42.00	440	<0.5	<0.5	<0.5	<0.5	30*
	9/6/01	53.41	13.62	0.00	39.79	410	<0.5	<0.5	<0.5	<0.5	56*
	12/11/01	53.41	12.02	0.00	41.39	510	<0.5	<0.5	<0.5	<0.5	42*
	3/12/02	53.41	9.54	0.00	43.87	110	<0.5	<0.5	<0.5	<0.5	26*
	6/11/02	53.41	11.53	0.00	41.88	590	<0.5	<0.5	<0.5	<0.5	18*
	9/9/02	56.55	13.38	0.00	43.17	390	<0.5	<0.5	<0.5	<0.5	18*
	12/20/02	56.55	12.26	0.00	44.29	520	<0.5	<0.5	<0.5	<0.5	17*
	3/12/03	56.55	9.83	0.00	46.72	190	<0.5	<0.5	<0.5	<0.5	14*
	6/6/03	56.55	9.78	0.00	46.77	310	<0.5	<0.5	<0.5	<0.5	9.2*

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Well No.	Sampling Date	TOC (feet)	DTW (feet)	*LNAPL (feet)	GWE (feet)	TPHg (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	MTBE (µg/L)
MW-5	9/17/03	56.55	13.88	0.00	42.67	100	<0.5	<0.5	<0.5	<0.5	7.4*
	12/5/03	56.55	13.71	0.00	42.84	190	<0.5	<0.5	<0.5	<0.5	9.1*
Screen	3/15/04	56.55	9.02	0.00	47.53	83	<0.5	<0.5	<0.5	<0.5	6.4*
5'-20'	6/9/04	56.55	11.13	0.00	45.42	73	<0.5	<0.5	<0.5	<0.5	4.9*
	9/13/04	56.55	13.37	0.00	43.18	<50	<0.5	<0.5	<0.5	<0.5	5.1*
	12/10/04	56.55	12.05	0.00	44.50	62	<0.5	<0.5	<0.5	<0.5	4.0*
	3/24/05	56.55	9.78	0.00	46.77	<50	<0.5	<0.5	<0.5	<0.5	3.9*
	6/1/05	56.55	9.67	0.00	46.88	71	<0.5	<0.5	<0.5	<0.5	2.8*
MW-6	11/21/91	Skimmer activated				---	---	---	---	---	---
	7/13/92	52.05	---	---	---	70%	0.66%	4.4%	1.2%	7.1%	---
Screen	9/2/92	52.05	14.40	0.26	37.86	---	---	---	---	---	---
5'-20'	10/28/92	52.05	14.52	0.26	37.74	---	---	---	---	---	---
	11/9/92	52.05	14.93	0.06	37.17	---	---	---	---	---	---
	1/12/93	52.05	13.65	1.88	39.90	---	---	---	---	---	---
	2/4/93	52.05	14.70	4.46	40.92	---	---	---	---	---	---
	5/5/93	52.05	14.35	6.08	42.56	---	---	---	---	---	---
	5/10/93	52.05	9.80	0.01	42.26	---	---	---	---	---	---
	5/27/93	52.05	14.48	5.71	42.14	---	---	---	---	---	---
	8/30/93	52.05	14.52	2.32	39.39	---	---	---	---	---	---
	9/14/93	52.05	14.60	2.29	39.28	---	---	---	---	---	---
	10/12/93	52.05	13.24	0.06	38.86	---	---	---	---	---	---
	11/29/93	52.05	13.72	0.09	38.40	---	---	---	---	---	---
	12/21/93	52.05	13.56	0.92	39.23	---	---	---	---	---	---
	1/12/94	52.05	13.01	0.67	39.58	---	---	---	---	---	---
	2/22/94	52.05	14.41	4.74	41.43	---	---	---	---	---	---
	3/24/94	52.05	11.19	1.02	41.68	---	---	---	---	---	---
	4/26/94	52.05	10.83	0.10	41.30	---	---	---	---	---	---
	5/18/94	52.05	13.99	4.43	41.60	---	---	---	---	---	---
	6/20/94	52.05	14.15	3.35	40.58	---	---	---	---	---	---
	10/19/94	52.05	15.40	1.91	38.18	---	---	---	---	---	---
	11/23/94	52.05	13.55	0.11	38.59	---	---	---	---	---	---
	12/23/94	52.05	13.43	1.43	39.76	---	---	---	---	---	---
	1/25/95	52.05	12.14	3.07	42.37	---	---	---	---	---	---
	2/23/95	52.05	11.22	2.35	42.71	---	---	---	---	---	---
	3/25/95	52.05	8.99	0.92	43.80	---	---	---	---	---	---
	2/24/97	52.05	8.44	0.70	44.17	220,000	16,000	24,000	3,800	25,100	<5,000
	5/26/97	52.05	---	0.38	---	---	---	---	---	---	---
	9/5/97	52.05	---	0.86	---	---	---	---	---	---	---
	12/11/97	52.05	---	0.75	---	---	---	---	---	---	---
	4/8/98	52.05	7.85	0.68	44.74	---	---	---	---	---	---
	6/22/98	52.05	---	0.14	---	---	---	---	---	---	---
	9/26/98	52.05	---	0.26	---	---	---	---	---	---	---
	1/14/99	52.05	10.75	2.20	43.06	---	---	---	---	---	---
	3/30/99	52.05	6.4	0.20	45.81	---	---	---	---	---	---
	6/28/99	52.05	7.86	0.24	44.43	---	---	---	---	---	---
	10/5/99	52.05	---	1.80	---	---	---	---	---	---	---
	12/10/99	52.05	---	0.75	---	---	---	---	---	---	---
	3/23/00	52.05	---	>2.0	---	---	---	---	---	---	---
	6/7/00	52.05	---	0.90	---	---	---	---	---	---	---
	9/18/00	52.05	---	0.41	---	---	---	---	---	---	---
	11/29/00	52.05	---	0.32	---	---	---	---	---	---	---
	3/22/01	52.05	---	0.15	---	---	---	---	---	---	---
	6/12/01	52.05	---	0.52	---	---	---	---	---	---	---
	9/7/01	52.05	---	0.13	---	---	---	---	---	---	---
	12/11/01	52.05	---	0.17	---	---	---	---	---	---	---
	3/12/02	52.05	---	0.09	---	---	---	---	---	---	---

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Well No.	Sampling Date	TOC (feet)	DTW (feet)	*LNAPL (feet)	GWE (feet)	TPHg (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	MTBE (µg/L)
MW-6	6/11/02	52.05	---	0.11	---	---	---	---	---	---	---
	9/9/02	55.20	---	0.02	---	---	---	---	---	---	---
Screen	12/20/02	55.20	---	0.03	---	---	---	---	---	---	---
5'-20'	3/12/03	55.20	---	0.03	---	---	---	---	---	---	---
	6/6/03	55.20	8.42	0.00	46.78	63,000	490	5,300	1,300	9,300	<20*
	9/17/03	55.20	12.87	0.00	42.33	71,000	1,100	6,200	1,500	10,000	<20*
	12/5/03	55.20	12.25	0.00	42.95	73,000	1,700	10,000	1,900	13,000	55*
	3/15/04	55.20	7.06	0.00	48.14	44,000	700	3,100	790	6,700	<20*
	6/9/04	55.20	9.73	0.00	45.47	75,000	1,900	4,700	1,300	12,000	<0.5*
	9/13/04	55.20	12.04	0.00	43.16	60,000	1,100	2,400	1,200	9,900	<20*
	12/10/04	55.20	8.46	0.00	46.74	33,000	120	960	660	4,300	<25*
	3/24/05	55.20	10.10	0.00	45.10	33,000	260	690	560	3,300	<5*
	6/1/05	55.20	10.08	0.00	45.12	27,000	65	580	460	2,600	<4*
MW-7	11/2/92	---	---	---	---	<50	<0.5	<0.5	<0.5	<0.5	---
	1/12/93	52.07	12.87	---	39.20	---	---	---	---	---	---
Screen	2/4/93	52.07	10.90	---	41.17	---	---	---	---	---	---
5'-20'	5/5/93	52.07	9.79	---	42.28	---	---	---	---	---	---
	5/10/93	52.07	9.74	---	42.33	<50	<0.5	<0.5	<0.5	<0.5	---
	8/30/93	52.07	12.81	---	39.26	---	---	---	---	---	---
	12/21/93	52.07	12.83	---	39.24	---	---	---	---	---	---
	3/24/94	52.07	10.41	---	41.66	<50	<0.5	<0.5	<0.5	<0.5	---
	4/26/94	52.07	10.76	---	41.31	---	---	---	---	---	---
	9/27/94	52.07	13.82	---	38.25	<50	<0.5	<0.5	<0.5	<0.5	---
	12/23/94	52.07	12.23	---	39.84	---	---	---	---	---	---
	3/25/95	52.07	8.42	---	43.65	---	---	---	---	---	---
	4/15/96	52.07	9.00	---	43.07	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	2/24/97	52.07	8.51	---	43.56	<50	<0.5	<0.5	<0.5	<0.5	7.4
	5/25/97	52.07	10.01	---	42.06	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	9/5/97	52.07	12.50	---	39.57	<50	<0.5	<0.5	<0.5	<0.5	10
	12/11/97	52.07	11.86	---	40.21	---	---	---	---	---	---
	4/8/98	52.07	7.21	---	44.86	<50	<0.5	<0.5	<0.5	<2.0	<5.0
	6/22/98	52.07	11.62	---	40.45	---	---	---	---	---	---
	9/26/98	52.07	NM	---	---	---	---	---	---	---	---
	1/14/99	52.07	12.12	---	39.95	---	---	---	---	---	---
	3/30/99	52.07	7.00	---	45.07	<50	<0.5	<0.5	<0.5	<0.5	<3.0
	6/28/99	52.07	10.86	---	41.21	---	---	---	---	---	---
	10/5/99	52.07	12.54	---	39.53	---	---	---	---	---	---
	12/10/99	52.07	11.22	---	40.85	---	---	---	---	---	---
	3/24/00	52.07	7.93	---	44.14	<50	<0.5	<0.5	<0.5	<1.0	<3.0
	6/7/00	52.07	9.99	---	42.08	---	---	---	---	---	---
	9/15/00	52.07	12.21	---	39.86	<50	0.5	2.0	0.7	2.9	<2.0*
	11/29/00	52.07	11.62	---	40.45	<50	<0.3	<0.3	<0.3	<0.6	<2.0*
	3/21/01	52.07	9.24	---	42.83	<50	<0.3	<0.3	<0.3	<0.6	2.3*
	6/5/01	52.07	10.40	---	41.67	<50	<0.5	<0.5	<0.5	<0.5	1.7*
	9/6/01	52.07	12.61	---	39.46	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	12/11/01	52.07	10.93	---	41.14	---	---	---	---	---	---
	3/12/02	52.07	8.52	---	43.55	<50	<0.5	<0.5	<0.5	<0.5	3.4*
	6/11/02	52.07	10.38	---	41.69	---	---	---	---	---	---
	9/9/02	55.22	12.18	---	43.04	---	---	---	---	---	---
	12/20/02	55.22	11.09	---	44.13	---	---	---	---	---	---
	3/12/03	55.22	8.67	---	46.55	<50	<0.5	<0.5	<0.5	<0.5	1.5*
	6/6/03	55.22	8.58	---	46.64	---	---	---	---	---	---
	9/17/03	55.22	13.03	---	42.19	---	---	---	---	---	---
	12/5/03	55.22	12.42	---	42.80	---	---	---	---	---	---
	3/15/04	55.22	7.87	---	47.35	<50	<0.5	<0.5	<0.5	<0.5	1.6*
	6/9/04	55.22	9.91	---	45.31	---	---	---	---	---	---

Table 3
GROUNDWATER ELEVATIONS AND
ANALYTICAL RESULTS
 Fortuna Beacon Petro Mart
 390 South Fortuna Boulevard
 Fortuna, California
 Blue Rock Project # FNC-3

Well No.	Sampling Date	TOC (feet)	DTW (feet)	*LNAPL (feet)	GWE (feet)	TPHg (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	MTBE (µg/L)
MW-7	9/13/04	55.22	12.15	---	43.07	---	---	---	---	---	---
	12/10/04	55.22	10.91	---	44.31	---	---	---	---	---	---
Screen 5'-20'	3/24/05	55.22	8.62	---	46.60	<50	<0.5	<0.5	<0.5	<0.5	0.57*
	6/1/05	55.22	8.56	---	46.66	---	---	---	---	---	---
MW-8	10/28/92	49.46	11.80	---	37.66	---	---	---	---	---	---
	11/2/92	---	---	---	---	<50	<0.5	<0.5	<0.5	<0.5	---
Screen 5'-20'	1/12/93	49.46	9.35	---	40.11	---	---	---	---	---	---
	2/4/93	49.46	8.40	---	41.06	---	---	---	---	---	---
5/5/93	49.46	7.19	---	42.27	---	---	---	---	---	---	---
	5/10/93	49.46	7.17	---	42.29	<50	<0.5	<0.5	<0.5	<0.5	---
8/30/93	49.46	10.10	---	39.36	---	---	---	---	---	---	---
	12/21/93	49.46	10.19	---	39.27	---	---	---	---	---	---
3/24/94	49.46	7.76	---	41.70	<50	<0.5	<0.5	<0.5	<0.5	<0.5	---
	4/26/94	49.46	8.12	---	41.34	---	---	---	---	---	---
9/27/94	49.46	11.17	---	38.29	---	---	---	---	---	---	---
	12/23/94	49.46	9.61	---	39.85	---	---	---	---	---	---
3/25/95	49.46	5.67	---	43.79	---	---	---	---	---	---	---
	4/15/96	49.46	10.72	---	38.74	<50	<0.5	<0.5	<0.5	<0.5	<5.0
2/24/97	49.46	9.52	---	39.94	---	---	---	---	---	---	---
	5/26/97	49.46	11.78	---	37.68	<50	<0.5	<0.5	<0.5	<0.5	34
9/5/97	49.46	14.30	---	35.16	<50	<0.5	1.0	<0.5	0.83	<5.0	---
	12/11/97	49.46	---	---	---	---	---	---	---	---	---
4/8/98	49.46	6.72	---	42.74	140	21	48	5	25	<5.0	---
	6/22/98	49.46	8.61	---	40.85	---	---	---	---	---	---
9/26/98	49.46	12.06	---	37.40	---	---	---	---	---	---	---
	1/14/99	49.46	9.55	---	39.91	---	---	---	---	---	---
3/30/99	49.46	6.60	---	42.86	<50	<0.5	<0.5	<0.5	<0.5	<0.5	<3.0
	6/28/99	49.46	10.79	---	38.67	---	---	---	---	---	---
10/5/99	49.46	12.65	---	36.81	---	---	---	---	---	---	---
	12/10/99	49.46	10.33	---	39.13	---	---	---	---	---	---
3/23/00	49.46	7.41	---	42.05	<50	<0.5	<0.5	<0.5	<0.5	<1.0	<3.0
	6/7/00	49.46	9.78	---	39.68	---	---	---	---	---	---
9/14/00	49.46	10.98	---	38.48	<50	<0.3	<0.3	<0.3	<0.3	<0.6	<2.0*
	11/29/00	49.46	11.08	---	38.38	<50	<0.3	<0.3	<0.3	<0.6	<2.0*
3/21/01	49.46	9.13	---	40.33	<50	<0.3	<0.3	<0.3	<0.3	<0.6	<2.0*
	6/5/01	49.46	10.15	---	39.31	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
9/6/01	49.46	12.77	---	36.69	<50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5*
Removed from quarterly sampling schedule											
MW-9	10/28/92	51.84	14.06	---	37.78	---	---	---	---	---	---
	11/2/92	---	---	---	---	<50	<0.5	<0.5	<0.5	<0.5	---
Screen 5'-20'	1/12/93	51.84	12.23	---	39.61	---	---	---	---	---	---
	2/4/93	51.84	10.44	---	41.40	---	---	---	---	---	---
3/2/93	51.84	9.80	---	42.04	<50	<0.5	1.2	<0.5	0.60	---	---
	5/5/93	51.84	9.20	---	42.64	---	---	---	---	---	---
8/30/93	51.84	---	---	---	<50	<0.5	<0.5	<0.5	<0.5	<0.5	---
	12/16/93	51.84	---	---	<50	<0.5	<0.5	<0.5	<0.5	<0.5	---
12/21/93	51.84	12.55	---	39.29	---	---	---	---	---	---	---
	3/24/94	51.84	9.88	---	41.96	---	---	---	---	---	---
4/26/94	51.84	10.32	---	41.52	---	---	---	---	---	---	---
	9/27/94	51.84	13.48	---	38.36	<50	<0.5	<1.0	<1.0	<1.0	---
12/23/94	51.84	12.19	---	39.65	---	---	---	---	---	---	---
	3/25/95	51.84	8.02	---	43.82	---	---	---	---	---	---
4/1/96	51.84	8.65	---	43.19	<50	<0.5	<0.5	<0.5	<0.5	<0.5	<5.0
	Well closed										

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GROUNDWATER ELEVATIONS AND
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 Fortuna Beacon Petro Mart
 390 South Fortuna Boulevard
 Fortuna, California
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Well No.	Sampling Date	TOC (feet)	DTW (feet)	*LNAPL (feet)	GWE (feet)	TPHg (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	MTBE (µg/L)
MW-10	10/28/92	55.18	17.15	---	38.03	---	---	---	---	---	---
	11/2/92	---	---	---	---	<50	<0.5	<0.5	<0.5	<0.5	---
Screen	1/12/93	55.18	15.63	---	39.55	---	---	---	---	---	---
5'-20'	2/4/93	55.18	13.50	---	41.68	---	---	---	---	---	---
	5/5/93	55.18	12.30	---	42.88	---	---	---	---	---	---
	5/10/93	55.18	12.25	---	42.93	<50	<0.5	<0.5	<0.5	<0.5	---
	8/30/93	55.18	15.46	---	39.72	---	---	---	---	---	---
	12/21/93	55.18	15.46	---	39.72	---	---	---	---	---	---
	3/24/94	55.18	12.91	---	42.27	<50	<0.5	0.84	<0.5	0.85	---
	4/26/94	55.18	13.19	---	41.99	---	---	---	---	---	---
	9/27/94	55.18	10.81	---	44.37	---	---	---	---	---	---
	12/23/94	55.18	14.84	---	40.34	---	---	---	---	---	---
	3/25/95	55.18	10.71	---	44.47	---	---	---	---	---	---
	4/15/96	55.18	11.48	---	43.70	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	2/24/97	55.18	11.01	---	44.17	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	5/25/97	55.18	12.81	---	42.37	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	9/5/97	55.18	15.19	---	39.99	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	12/11/97	55.18	14.28	---	40.90	---	---	---	---	---	---
	4/8/98	55.18	9.50	---	45.68	<50	<0.5	<0.5	<0.5	<2.0	<5.0
	6/22/98	55.18	12.76	---	42.42	---	---	---	---	---	---
	9/26/98	55.18	14.62	---	40.56	---	---	---	---	---	---
	1/14/99	55.18	12.36	---	42.82	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	3/30/99	55.18	9.56	---	45.62	<50	<0.5	<0.5	<0.5	<0.5	<3.0
	6/28/99	55.18	12.16	---	43.02	---	---	---	---	---	---
	10/5/99	55.18	15.35	---	39.83	---	---	---	---	---	---
	12/10/99	55.18	13.78	---	41.40	---	---	---	---	---	---
	3/24/00	55.18	10.42	---	44.76	<50	<0.5	<0.5	<0.5	<1.0	<3.0
	6/7/00	55.18	12.65	---	42.53	---	---	---	---	---	---
	9/15/00	55.18	14.77	---	40.41	<50	<0.3	<0.3	<0.3	<0.6	<2.0*
	11/29/00	55.18	14.21	---	40.97	<50	<0.3	<0.3	<0.3	<0.6	<2.0*
	3/21/01	55.18	11.83	---	43.35	<50	<0.3	<0.3	<0.3	<0.6	<2.0*
	6/5/01	55.18	13.01	---	42.17	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	9/6/01	55.18	15.41	---	39.77	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
Removed from quarterly sampling schedule											
MW-11	10/28/92	53.14	15.45	---	37.69	---	---	---	---	---	---
	11/2/92	---	---	---	---	<50	<0.5	<0.5	<0.5	<0.5	---
Screen	1/12/93	53.14	13.18	---	39.96	---	---	---	---	---	---
5'-20'	2/4/93	53.14	11.90	---	41.24	---	---	---	---	---	---
	3/2/93	53.14	3.88	---	49.26	<50	<0.5	0.60	<0.5	0.50	---
	5/5/93	53.14	7.60	---	45.54	---	---	---	---	---	---
	8/30/93	53.14	13.91	---	39.23	---	---	---	---	---	---
	12/16/93	---	---	---	<50	<0.5	<0.5	<0.5	<0.5	<0.5	---
	12/21/93	53.14	9.96	---	43.18	---	---	---	---	---	---
	3/24/94	53.14	3.46	---	49.68	---	---	---	---	---	---
	4/26/94	53.14	3.83	---	49.31	---	---	---	---	---	---
	6/20/94	53.14	11.76	---	41.38	<50	<0.5	<0.5	<0.5	<0.5	---
	9/27/94	53.14	14.81	---	38.33	119	<0.5	<1.0	<1.0	<1.0	---
	12/23/94	53.14	12.17	---	40.97	---	---	---	---	---	---
	3/25/95	53.14	3.26	---	49.88	<50	---	---	---	---	---
	4/15/96	53.14	6.38	---	46.76	<50	<0.5	<0.5	<0.5	<2.0	<5.0
	2/24/97	53.14	4.36	---	48.78	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	5/25/97	53.14	10.79	---	42.35	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	9/5/97	53.14	13.50	---	39.64	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	12/11/97	53.14	6.79	---	46.35	---	---	---	---	---	---
	4/8/98	53.14	4.34	---	48.80	<50	<0.5	<0.5	<0.5	<2.0	<5.0
	6/22/98	53.14	6.79	---	46.35	---	---	---	---	---	---

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 Fortuna Beacon Petro Mart
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Well No.	Sampling Date	TOC (feet)	DTW (feet)	*LNAPL (feet)	GWE (feet)	TPHg (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	MTBE (µg/L)
MW-11	9/26/98	53.14	---	---	---	---	---	---	---	---	---
	1/14/99	53.14	6.46	---	46.68	---	---	---	---	---	---
Screen	3/30/99	53.14	3.77	---	49.37	<50	<0.5	<0.5	<0.5	<0.5	<3.0
5'-20'	6/28/99	53.14	11	---	42.14	---	---	---	---	---	---
	10/5/99	53.14	13.49	---	39.65	---	---	---	---	---	---
	12/10/99	53.14	3.88	---	49.26	---	---	---	---	---	---
	3/24/00	53.14	4.21	---	48.93	<50	<0.5	<0.5	<0.5	<1.0	<3.0
	6/7/00	53.14	4.79	---	48.35	---	---	---	---	---	---
	9/15/00	53.14	12.76	---	40.38	<50	<0.3	1.8	0.9	4.4	31.8*
	11/29/00	53.14	5.03	---	48.11	<50	<0.3	<0.3	<0.3	<0.6	5.8*
	3/21/01	53.14	4.93	---	48.21	<50	<0.3	<0.3	<0.3	<0.6	9.5*
	6/5/01	53.14	7.55	---	45.59	<50	<0.5	<0.5	<0.5	<0.5	48*
	9/6/01	53.14	13.58	---	39.56	<50	<0.5	<0.5	<0.5	<0.5	0.79*
	12/11/01	53.14	10.86	---	42.28	---	---	---	---	---	---
	3/12/02	53.14	8.57	---	44.57	<50	<0.5	<0.5	<0.5	<0.5	5.6*
	6/11/02	53.14	11.22	---	41.92	---	---	---	---	---	---
	9/9/02	56.24	13.17	---	43.07	---	---	---	---	---	---
	12/20/02	56.24	11.81	---	44.43	---	---	---	---	---	---
	3/12/03	56.24	9.37	---	46.87	<50	<0.5	<0.5	<0.5	<0.5	0.72*
	6/6/03	56.24	9.33	---	46.91	---	---	---	---	---	---
	9/17/03	56.24	13.55	---	42.69	---	---	---	---	---	---
	12/5/03	56.24	13.22	---	43.02	---	---	---	---	---	---
	3/15/04	56.24	8.82	---	47.42	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	6/9/04	56.24	10.86	---	45.38	---	---	---	---	---	---
	9/13/04	56.24	13.15	---	43.09	---	---	---	---	---	---
	12/10/04	56.24	11.89	---	44.35	---	---	---	---	---	---
	3/24/05	56.24	9.60	---	46.64	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	6/1/05	56.24	9.58	---	46.66	---	---	---	---	---	---
MW-12	12/16/93	---	---	---	670	5.7	19	6.2	48	---	---
	12/21/93	53.73	14.37	---	39.36	---	---	---	---	---	---
Screen	3/24/94	53.73	11.93	---	41.80	3,500	16	88	28	164	---
5'-20'	4/26/94	53.73	12.28	---	41.45	---	---	---	---	---	---
	9/27/94	53.73	16.24	---	37.49	---	---	---	---	---	---
	12/23/94	53.73	14.26	---	39.47	---	---	---	---	---	---
	3/25/95	53.73	10.17	---	43.56	---	---	---	---	---	---
	4/15/96	53.73	10.45	---	43.28	4,700	9	49	120	530	<300
	2/24/97	53.73	10.46	---	43.27	5,900	<5.0	57	180	750	<50
	5/26/97	53.73	11.51	---	42.22	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	9/5/97	53.73	13.92	---	39.81	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	12/11/97	53.73	12.60	---	41.13	59	<0.5	<0.5	<0.5	<0.5	1.3
	4/9/98	53.73	8.72	---	45.01	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	6/22/98	53.73	10.37	---	43.36	<50	<0.5	<0.5	<0.5	0.62	<5.0
	9/26/98	53.73	13.35	---	40.38	100	<0.5	<0.5	<0.5	2.60	<5.0
	1/14/99	53.73	11.10	---	42.63	160	<0.5	1.1	2.9	14.4	<11
	3/30/99	53.73	8.49	---	45.24	<50	<0.5	<0.5	<0.5	<0.5	<3.0
	6/28/99	53.73	11.71	---	42.02	<50	<0.5	<0.5	<0.5	<0.5	<3.0
	10/5/99	53.73	14.08	---	39.65	4,200	<8.0	27	200	670	<100
	12/10/99	53.73	13.03	---	40.70	4,700	<3.0	17	160	560	<100
	3/24/00	53.73	9.45	---	44.28	390	<2.0	3.7	26	84	6.0
	6/7/00	53.73	10.42	---	43.31	2,680	<0.3	17	125	435	<2.0 *
	9/15/00	53.73	13.66	---	40.07	1,810	<0.3	9.0	103	277	<2.0 *
	11/29/00	53.73	13.21	---	40.52	3,500	<0.3	7.2	156	467	<2.0 *
	3/21/01	53.73	11.73	---	42.00	4,880	<0.3	7.9	227	566	<2.0 *
	6/5/01	53.73	11.94	---	41.79	2,200	<0.5	6.2	96	270	<0.5*
	9/6/01	53.73	14.17	---	39.56	730	<0.5	1.8	40	83	<0.5*
	12/11/01	53.73	13.04	---	40.69	1,900	81	46	52	110	7.7*

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Well No.	Sampling Date	TOC (feet)	DTW (feet)	*LNAPL (feet)	GWE (feet)	TPHg (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	MTBE (µg/L)
MW-12	3/12/02	53.73	9.92	---	43.81	1,800	<0.5	<0.5	31	17	<0.5*
	6/11/02	53.73	11.79	---	41.94	990	<0.5	1.1	52	85	<0.5*
Screen	9/9/02	56.90	13.78	---	43.12	1,600	<0.5	1.3	69	77	<0.5*
5'-20'	12/20/02	56.90	13.15	---	43.75	850	<0.5	<0.5	31	21	<0.5*
	3/12/03	56.90	10.13	---	46.77	2,700	<0.5	0.63	51	38	<0.5*
	6/6/03	56.90	9.99	---	46.91	890	<0.5	<0.5	21	11	<0.5*
	9/17/03	56.90	14.24	---	42.66	1,600	<0.5	<0.5	55	32	<0.5*
	12/5/03	56.90	13.86	---	43.04	500	<0.5	<0.5	21	7.9	<0.5*
	3/15/04	56.90	9.42	---	47.48	830	<0.5	<0.5	17	5	<0.5*
	6/9/04	56.90	10.71	---	46.19	1,600	<0.5	<0.5	37	17	<0.5*
	9/13/04	56.90	13.80	---	43.10	610	<0.5	<0.5	12	4.0	<0.5*
	12/10/04	56.90	12.62	---	44.28	440	<0.5	<0.5	4.9	4.5	<0.5*
	3/24/05	56.90	10.46	---	46.44	1,600	<0.5	0.58	18	25	<0.5*
	6/1/05	56.90	9.98	---	46.92	2,100	<0.5	1.1	26	46	0.86*
MW-13	12/16/93	---	---	---	<50	1.4	2.3	<0.5	1.53	---	---
	12/21/93	52.64	13.38	---	39.26	---	---	---	---	---	---
Screen	3/24/94	52.64	10.73	---	41.91	<50	<0.5	<0.5	<0.5	<0.5	---
5'-20'	4/26/94	52.64	10.11	---	42.53	---	---	---	---	---	---
	9/27/94	52.64	14.32	---	38.32	<50	<0.5	<1.0	<1.0	<1.0	---
	3/25/95	52.64	2.89	---	49.75	---	---	---	---	---	---
	4/15/96	52.64	3.42	---	49.22	<50	<0.5	<0.5	<0.5	<2.0	<5.0
	2/24/97	52.64	3.05	---	49.59	<50	<0.5	<0.5	<0.5	<0.5	34
	5/25/97	52.64	3.75	---	48.89	<50	<0.5	<0.5	<0.5	<0.5	74
	9/5/97	52.64	4.58	---	48.06	<50	<0.5	<0.5	<0.5	<0.5	22
	12/11/97	52.64	3.82	---	48.82	---	---	---	---	---	---
	4/9/98	52.64	---	---	---	---	---	---	---	---	---
	6/22/98	52.64	3.00	---	49.64	130	<0.5	1.4	0.90	5.8	<5.0
	9/26/98	52.64	4.31	---	48.33	---	---	---	---	---	---
	1/14/99	52.64	3.00	---	49.64	---	---	---	---	---	---
	3/30/99	52.64	3.00	---	49.64	<50	<0.5	<0.5	<0.5	<0.5	<3.0
	6/28/99	52.64	10.86	---	41.78	---	---	---	---	---	---
	10/5/99	52.64	3.53	---	49.11	---	---	---	---	---	---
	12/10/99	52.64	2.99	---	49.65	---	---	---	---	---	---
	3/24/00	52.64	3.22	---	49.42	<50	<0.5	1.3	<0.5	2.5	<3.0
	6/7/00	52.64	3.32	---	49.32	---	---	---	---	---	---
	9/15/00	52.64	3.32	---	49.32	<50	<0.3	<0.3	<0.3	<0.6	<2.0*
	11/29/00	52.64	3.17	---	49.47	<50	0.4	2.2	0.3	1.8	<2.0*
	3/21/01	52.64	3.37	---	49.27	<50	<0.3	<0.3	0.4	1.9	<2.0*
	6/5/01	52.64	4.51	---	48.13	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	9/6/01	52.64	4.14	---	48.50	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	12/11/01	52.64	3.08	---	49.56	---	---	---	---	---	---
	3/12/02	52.64	---	No Access	---	---	---	---	---	---	---
	6/11/02	52.64	3.48	---	49.16	---	---	---	---	---	---
	9/9/02	55.81	3.75	---	52.06	---	---	---	---	---	---
	12/20/02	55.81	2.80	---	53.01	---	---	---	---	---	---
	3/12/03	55.81	3.37	---	52.44	<50	<0.5	<0.5	<0.5	<0.5	0.56*
	6/6/03	55.81	3.38	---	52.43	---	---	---	---	---	---
	9/17/03	55.81	---	No Access	---	---	---	---	---	---	---
	12/5/03	55.81	4.24	---	51.57	---	---	---	---	---	---
	3/15/04	55.81	3.31	---	52.50	<50	<0.5	<0.5	<0.5	<0.5	3.1*
	6/9/04	55.81	3.67	---	52.14	---	---	---	---	---	---
	9/13/04	55.81	3.93	---	51.88	---	---	---	---	---	---
	12/10/04	55.81	3.05	---	52.76	---	---	---	---	---	---
	3/24/05	55.81	3.06	---	52.75	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	6/1/05	55.81	3.37	---	52.44	---	---	---	---	---	---

Table 3
GROUNDWATER ELEVATIONS AND
ANALYTICAL RESULTS
 Fortuna Beacon Petro Mart
 390 South Fortuna Boulevard
 Fortuna, California
 Blue Rock Project # FNC-3

Well No.	Sampling Date	TOC (feet)	DTW (feet)	*LNAPL (feet)	GWE (feet)	TPHg (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	MTBE (µg/L)
MW-14	4/15/96	55.17	11.87	---	43.30	3,200	170	<0.5	<0.5	<2.0	---
	2/24/97	55.17	11.56	---	43.61	590	61	<0.5	3.1	<0.5	<5.0
Screen	5/26/97	55.17	12.98	---	42.19	1900	71	<7.0	0.65	1.5	<130
10'-20'	9/5/97	55.17	15.38	---	39.79	180	16	<0.5	<0.5	<0.5	<5.0
	12/11/97	55.17	---	---	---	---	---	---	---	---	---
	4/9/98	55.17	---	---	---	---	---	---	---	---	---
	6/22/98	55.17	---	---	---	---	---	---	---	---	---
	9/26/98	55.17	12.95	---	42.22	---	---	---	---	---	---
	1/14/99	55.17	10.69	---	44.48	---	---	---	---	---	---
	3/30/99	55.17	8.09	---	47.08	79	2.5	<5.0	<0.5	<0.5	5.9
	6/28/99	55.17	11.92	---	43.25	<50	<0.5	<0.5	<0.5	<0.5	<3.0
	10/5/99	55.17	13.68	---	41.49	<50	<0.5	<0.5	<0.5	<1.0	<3.0
	12/10/99	55.17	12.37	---	42.8	<50	1.6	<0.5	<0.5	<1.0	<3.0
	3/23/00	55.17	9.09	---	46.08	<50	1.7	1.2	<0.5	<1.0	<3.0
	6/7/00	55.17	11.16	---	44.01	190	11	<0.3	1.7	3	<2.0*
	9/14/00	55.17	13.29	---	41.88	1,060	106	6.8	15.8	7.3	<2.0*
	11/29/00	55.17	12.64	---	42.53	738	139	12	42	7.7	<2.0*
	3/21/01	55.17	10.27	---	44.90	334	84.4	1.4	22.1	<0.6	<2.0*
	6/5/01	55.17	11.46	---	43.71	<50	4.3	<0.5	1.9	<0.5	<0.5*
	9/6/01	55.17	13.78	---	41.39	570	110	1.6	13	0.95	<0.5*
	12/11/01	55.17	12.04	---	43.13	600	30	2.6	3.1	4.8	<0.5*
	3/12/02	55.17	9.60	---	45.57	990	200	4.5	12	3.5	<0.5*
	6/11/02	55.17	11.56	---	43.61	560	110	2.7	28	1.2	<0.5*
	9/9/02	56.52	13.31	---	43.21	790	75	3.2	22	1.5	<0.5*
	12/20/02	56.52	12.22	---	44.30	1,100	130	7.0	21	8.7	<0.5*
	3/12/03	56.52	9.74	---	46.78	1,300	270	7.0	37	4.0	<0.5*
	6/6/03	56.52	9.71	---	46.81	1,400	100	3.5	45	3.1	<0.5*
	9/17/03	56.52	13.80	---	42.72	2,600	210	38	87	54	<0.5*
	12/5/03	56.52	13.49	---	43.03	2,200	190	23	81	32	<0.5*
	3/15/04	56.52	8.93	---	47.59	1,800	190	8.1	84	8.4	<0.5*
	6/9/04	56.52	11.02	---	45.50	1,900	100	9.6	71	13	<0.5*
	9/13/04	56.52	13.29	---	43.23	1,400	150	6.2	55	1.1	<0.5*
	12/10/04	56.52	12.05	---	44.47	2,300	430	46	68	21	<0.5*
	3/24/05	56.52	9.72	---	46.80	1,800	370	4.9	41	0.64	<0.5*
	6/1/05	56.52	9.66	---	46.86	1,800	220	4.9	67	3.1	<0.5*
MW-15	7/23/98	54.21	12.44	---	41.77	<50	<0.5	<0.5	<0.5	0.72	<5.0
	9/26/98	54.21	13.55	---	40.66	<50	<0.5	<0.5	<0.5	<0.5	<5.0
Screen	1/14/99	54.21	12.15	---	42.06	<50	<0.5	<0.5	<0.5	<0.5	<5.0
10'-20'	3/30/99	54.21	8.37	---	45.84	<50	<0.5	<0.5	<0.5	<0.5	<3.0
	6/28/99	54.21	11.96	---	42.25	---	---	---	---	---	---
	10/5/99	54.21	13.61	---	40.60	---	---	---	---	---	---
	12/10/99	54.21	13.88	---	40.33	---	---	---	---	---	---
	3/23/00	54.21	9.43	---	44.78	<50	<0.5	<0.5	<0.5	<1.0	<3.0
	6/7/00	54.21	11.31	---	42.90	---	---	---	---	---	---
	9/14/00	54.21	13.18	---	41.03	<50	<0.3	<0.3	<0.3	<0.6	<2.0*
	11/29/00	54.21	12.33	---	41.88	<50	<0.3	<0.3	<0.3	<0.6	<2.0*
	3/21/01	54.21	10.29	---	43.92	<70	<0.4	<0.4	<0.4	<0.8	<2.8*
	6/5/01	54.21	11.35	---	42.86	<50	<0.5	<0.5	<0.5	<0.5	0.97*
	9/6/01	54.21	14.01	---	40.20	<50	<0.5	<0.5	<0.5	<0.5	0.57*
	12/11/01	54.21	11.7	---	42.51	---	---	---	---	---	---
	3/12/02	54.21	10.83	---	43.38	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	6/11/02	54.21	11.57	---	42.64	---	---	---	---	---	---
	9/9/02	57.38	13.29	---	44.09	---	---	---	---	---	---
	12/20/02	57.38	11.81	---	45.57	---	---	---	---	---	---
	3/12/03	57.38	10.07	---	47.31	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	6/6/03	57.38	9.73	---	47.65	---	---	---	---	---	---

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 Blue Rock Project # FNC-3

Well No.	Sampling Date	TOC (feet)	DTW (feet)	*LNAPL (feet)	GWE (feet)	TPHg ($\mu\text{g/L}$)	Benzene ($\mu\text{g/L}$)	Toluene ($\mu\text{g/L}$)	Ethylbenzene ($\mu\text{g/L}$)	Xylenes ($\mu\text{g/L}$)	MTBE ($\mu\text{g/L}$)
MW-15	9/17/03	57.38	13.41	---	43.97	---	---	---	---	---	---
	12/5/03	57.38	13.10	---	44.28	---	---	---	---	---	---
Screen	3/15/04	57.38	8.89	---	48.49	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
10'-20'	6/9/04	57.38	11.11	---	46.27	---	---	---	---	---	---
	9/13/04	57.38	13.34	---	44.04	---	---	---	---	---	---
	12/10/04	57.38	11.60	---	45.78	---	---	---	---	---	---
	3/24/05	57.38	9.43	---	47.95	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	6/1/05	57.38	10.85	---	46.53	---	---	---	---	---	---
MW-16	7/23/98	54.44	11.47	---	42.97	<50	<0.5	<0.5	<0.5	<0.5	14
	9/26/98	54.44	14.06	---	40.38	<50	<0.5	<0.5	<0.5	<0.5	6.3
Screen	1/14/99	54.44	11.76	---	42.68	<50	<0.5	<0.5	<0.5	<0.5	11
10'-20'	3/30/99	54.44	9.18	---	45.26	<50	<0.5	<0.5	<0.5	<0.5	7.5
	6/28/99	54.44	12.26	---	42.18	---	---	---	---	---	---
	10/5/99	54.44	14.81	---	39.63	---	---	---	---	---	---
	12/10/99	54.44	13.52	---	40.92	---	---	---	---	---	---
	3/24/00	54.44	10.19	---	44.25	<50	<0.5	<0.5	<0.5	<1.0	23*
	6/7/00	54.44	12.22	---	42.22	---	---	---	---	---	---
	9/15/00	54.44	14.44	---	40.00	<50	<0.3	<0.3	<0.3	<0.6	7.7*
	11/29/00	54.44	13.89	---	40.55	<50	<0.3	<0.3	<0.3	<0.6	2.9*
	3/21/01	54.44	11.55	---	42.89	<50	<0.3	<0.3	<0.3	<0.6	<2.0*
	6/5/01	54.44	12.62	---	41.82	<50	<0.5	<0.5	<0.5	<0.5	0.78*
	9/6/01	54.44	14.82	---	39.62	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	12/11/01	54.44	13.21	---	41.23	---	---	---	---	---	---
	3/12/02	54.44	10.81	---	43.63	<50	<0.5	<0.5	<0.5	<0.5	0.71*
	6/11/02	54.44	12.62	---	41.82	---	---	---	---	---	---
	9/9/02	57.56	14.45	---	43.11	---	---	---	---	---	---
	12/20/02	57.56	13.34	---	44.22	---	---	---	---	---	---
	3/12/03	57.56	10.89	---	46.67	<50	<0.5	<0.5	<0.5	<0.5	0.61*
	6/6/03	57.56	10.82	---	46.74	---	---	---	---	---	---
	9/17/03	57.56	14.96	---	42.60	---	---	---	---	---	---
	12/5/03	57.56	14.63	---	42.93	---	---	---	---	---	---
	3/15/04	57.56	10.09	---	47.47	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	6/9/04	57.56	12.15	---	45.41	---	---	---	---	---	---
	9/13/04	57.56	13.34	---	44.22	---	---	---	---	---	---
	12/10/04	57.56	13.17	---	44.39	---	---	---	---	---	---
	3/24/05	57.56	10.89	---	46.67	<50	<0.5	<0.5	<0.5	<0.5	93*
	6/1/05	57.56	10.82	---	46.74	---	---	---	---	---	---
<u>Deep Well</u>	4/15/96	54.66	11.46	---	43.20	200	42	2.0	<0.5	2.0	---
DW-1	2/24/97	54.66	11.15	---	43.51	<50	<0.5	<0.5	<0.5	<0.5	5.7
	5/23/97	54.66	12.54	---	42.12	<50	<0.5	<0.5	<0.5	<0.5	11
Screen	9/5/97	54.66	14.95	---	39.71	<50	<0.5	<0.5	<0.5	<0.5	<5.0
30'-40'	12/11/97	54.66	13.60	---	41.06	<50	<0.5	<0.5	<0.5	<0.5	390
	4/9/98	54.66	9.70	---	44.96	<50	<0.5	<0.5	<0.5	<2.0	9
	6/22/98	54.66	10.36	---	44.30	---	---	---	---	---	---
	9/26/98	54.66	14.28	---	40.38	---	---	---	---	---	---
	1/14/99	54.66	12.10	---	42.56	---	---	---	---	---	---
	3/30/99	54.66	9.49	---	45.17	<50	<0.5	<0.5	<0.5	<0.5	630
	6/28/99	54.66	16.26	---	38.40	---	---	---	---	---	---
	10/5/99	54.66	15.02	---	39.64	---	---	---	---	---	---
	12/10/99	54.66	13.72	---	40.94	---	---	---	---	---	---
	3/23/00	54.66	10.46	---	44.20	110	1.1	<0.5	<0.5	<1.0	390*
	6/7/00	54.66	12.47	---	42.19	---	---	---	---	---	---
	9/14/00	54.66	14.73	---	39.93	<50	<0.3	1.1	1.1	1.0	18.7*
	11/29/00	54.66	14.13	---	40.53	<50	13.3	<6	<6	<12	386*
	3/21/01	54.66	11.74	---	42.92	<50	<0.3	<0.3	<0.3	<0.6	<2.0*

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Well No.	Sampling Date	TOC (feet)	DTW (feet)	*LNAPL (feet)	GWE (feet)	TPHg (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	MTBE (µg/L)
DW-1	6/5/01	54.66	12.93	---	41.73	160	56	<0.5	<0.5	1.7	340*
	9/6/01	54.66	15.12	---	39.54	<50	<0.5	<0.5	<0.5	<0.5	27*
Screen	12/11/01	54.66	13.43	---	41.23	900	240	7.7	4.9	47	310*
30'-40'	3/12/02	54.66	11.05	---	43.61	510	260	<2	<2	<2	210*
	6/11/02	54.66	12.93	---	41.73	420	120	<0.5	1.4	<0.5	170*
	9/9/02	57.81	14.71	---	43.10	<50	<0.5	<0.5	<0.5	<0.5	17*
	12/20/02	57.81	13.61	---	44.20	<50	<0.5	<0.5	<0.5	<0.5	19*
	3/12/03	57.81	11.20	---	46.61	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	6/6/03	57.81	11.13	---	46.68	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	9/17/03	57.81	15.27	---	42.54	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	12/5/03	57.81	14.97	---	42.84	<50	1.7	<0.5	<0.5	<0.5	3.1*
	3/15/04	57.81	10.40	---	47.41	<50	2.4	<0.5	<0.5	<0.5	33*
	6/9/04	57.81	12.44	---	45.37	<50	<0.5	<0.5	<0.5	<0.5	0.68*
	9/13/04	57.81	14.68	---	43.13	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	12/10/04	57.81	13.45	---	44.36	<50	<0.5	<0.5	<0.5	<0.5	0.93*
	3/24/05	57.81	11.16	---	46.65	<50	<0.5	<0.5	<0.5	<0.5	0.89*
	6/1/05	57.81	11.10	---	46.71	<50	<0.5	<0.5	<0.5	<0.5	0.96*
DW-2	4/15/96	55.05	11.83	---	43.22	<50	<0.5	0.9	0.6	3.0	---
	2/24/97	55.05	11.52	---	43.53	<50	<0.5	<0.5	<0.5	<0.5	<5.0
Screen	5/25/97	55.05	12.92	---	42.13	<50	<0.5	<0.5	<0.5	<0.5	<5.0
30'-40'	9/5/97	55.05	15.31	---	39.74	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	12/11/97	55.05	---	---	---	---	---	---	---	---	---
	4/9/98	55.05	---	---	---	---	---	---	---	---	---
	6/22/98	55.05	---	---	---	---	---	---	---	---	---
	9/26/98	55.05	12.5	---	42.55	---	---	---	---	---	---
	1/14/99	55.05	10.26	---	44.79	---	---	---	---	---	---
	3/30/99	55.05	7.69	---	47.36	<50	<0.5	<0.5	<0.5	<0.5	<3.0
	6/28/99	55.05	14.20	---	40.85	---	---	---	---	---	---
	10/5/99	55.05	13.24	---	41.81	---	---	---	---	---	---
	12/10/99	55.05	11.91	---	43.14	---	---	---	---	---	---
	3/23/00	55.05	8.72	---	46.33	<50	<0.5	<0.5	<0.5	<1.0	<3.0
	6/7/00	55.05	10.72	---	44.33	---	---	---	---	---	---
	9/14/00	55.05	12.89	---	42.16	<50	<0.3	<0.3	<0.3	<0.6	<2.0*
	11/29/00	55.05	12.28	---	42.77	<50	<0.3	<0.3	<0.3	<0.6	<2.0*
	3/21/01	55.05	9.91	---	45.14	<50	<0.3	<0.3	<0.3	<0.6	<2.0*
	6/5/01	55.05	11.09	---	43.96	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	9/6/01	55.05	13.32	---	41.73	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	12/11/01	55.05	11.59	---	43.46	---	---	---	---	---	---
	3/12/02	55.05	6.21	---	48.84	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	6/11/02	55.05	11.12	---	43.93	---	---	---	---	---	---
	9/9/02	55.99	12.88	---	43.11	---	---	---	---	---	---
	12/20/02	55.99	11.78	---	44.21	---	---	---	---	---	---
	3/12/03	55.99	9.35	---	46.64	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	6/6/03	55.99	9.31	---	46.68	---	---	---	---	---	---
	9/17/03	55.99	13.43	---	42.56	---	---	---	---	---	---
	12/5/03	55.99	13.10	---	42.89	---	---	---	---	---	---
	3/15/04	55.99	8.57	---	47.42	<50	<0.5	<0.5	<0.5	<0.5	0.56*
	6/9/04	55.99	10.61	---	45.38	---	---	---	---	---	---
	9/13/04	55.99	12.86	---	43.13	---	---	---	---	---	---
	12/10/04	55.99	11.61	---	44.38	---	---	---	---	---	---
	3/24/05	55.99	9.32	---	46.67	<50	<0.5	<0.5	<0.5	<0.5	1.0*
	6/1/05	55.99	9.25	---	46.74	---	---	---	---	---	---
DW-3	4/15/96	53.30	10.15	---	43.15	3,200	170	<0.5	<0.5	<2.0	---
	2/24/97	53.30	9.82	---	43.48	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	5/26/97	53.30	11.20	---	42.10	<50	<0.5	<0.5	<0.5	<0.5	<5.0

Table 3
GROUNDWATER ELEVATIONS AND
ANALYTICAL RESULTS
 Fortuna Beacon Petro Mart
 390 South Fortuna Boulevard
 Fortuna, California
 Blue Rock Project # FNC-3

Well No.	Sampling Date	TOC (feet)	DTW (feet)	*LNAPL (feet)	GWE (feet)	TPHg (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	MTBE (µg/L)
DW-3	9/5/97	53.30	14.61	---	38.69	<50	<0.5	<0.5	<0.5	<0.5	<5.0
	12/11/97	53.30	12.27	---	41.03	<50	<0.5	<0.5	<0.5	<0.5	<5.0
Screen	4/8/98	53.30	8.38	---	44.92	<50	<0.5	<0.5	<0.5	<2.0	<5.0
30'-40'	6/22/98	53.30	9.42	---	43.88	---	---	---	---	---	---
	9/26/98	53.30	13.10	---	40.20	---	---	---	---	---	---
	1/14/99	53.30	11.86	---	41.44	---	---	---	---	---	---
	3/30/99	53.30	8.18	---	45.12	<50	<0.5	<0.5	<0.5	<0.5	3.3
	6/28/99	53.30	14.16	---	39.14	---	---	---	---	---	---
	10/5/99	53.30	13.73	---	39.57	---	---	---	---	---	---
	12/10/99	53.30	12.43	---	40.87	---	---	---	---	---	---
	3/24/00	53.30	9.14	---	44.16	100	<0.5	<0.5	<0.5	<1.0	390*
	6/7/00	53.30	11.16	---	42.14	---	---	---	---	---	---
	9/15/00	53.30	13.79	---	39.51	<50	0.8	4.1	1.7	6.6	12.7*
	11/29/00	53.30	12.82	---	40.48	140	<0.3	<0.3	<0.3	<0.6	358*
	3/21/01	53.30	10.45	---	42.85	243	2.0	<0.3	<0.3	<0.6	435*
	6/5/01	53.30	11.60	---	41.70	180	63	<0.5	<0.5	<0.5	310*
	9/6/01	53.30	13.79	---	39.51	<50	<0.5	<0.5	<0.5	<0.5	290*
	12/11/01	53.30	12.12	---	41.18	<50	<0.5	<0.5	<0.5	<0.5	290*
	3/12/02	53.30	9.72	---	43.58	<50	<0.5	<0.5	<0.5	<0.5	220*
	6/11/02	53.30	11.57	---	41.73	<50	<0.5	<0.5	<0.5	<0.5	180*
	9/9/02	56.45	13.39	---	43.06	<50	<0.5	<0.5	<0.5	<0.5	170*
	12/20/02	56.45	12.31	---	44.14	<50	<0.5	<0.5	<0.5	<0.5	140*
	3/12/03	56.45	9.88	---	46.57	<50	<0.5	<0.5	<0.5	0.74	94*
	6/6/03	56.45	9.79	---	46.66	<50	<0.5	<0.5	<0.5	<0.5	38*
	9/17/03	56.45	13.96	---	42.49	<50	<0.5	<0.5	<0.5	<0.5	27*
	12/5/03	56.45	13.64	---	42.81	<50	<0.5	<0.5	<0.5	<0.5	16*
	3/15/04	56.45	9.08	---	47.37	<50	<0.5	<0.5	<0.5	<0.5	4.9*
	6/9/04	56.45	11.12	---	45.33	<50	<0.5	<0.5	<0.5	<0.5	5.9*
	9/13/04	56.45	13.37	---	43.08	<50	<0.5	<0.5	<0.5	<0.5	4.5*
	12/10/04	56.45	12.13	---	44.32	<50	<0.5	<0.5	<0.5	<0.5	4.5*
	3/24/05	56.45	9.83	---	46.62	<50	<0.5	<0.5	<0.5	<0.5	1.7*
	6/1/05	56.45	9.77	---	46.68	<50	<0.5	<0.5	<0.5	<0.5	1.1*
Recovery Wells											
RW-1	11/29/00	54.93	13.66	---	41.27	387,000	6,030	62,500	6,450	57,100	123*
	3/21/01	54.93	11.23	---	43.70	83,900	2,100	8,970	3,610	14,100	79*
Screen	6/5/01	54.93	12.47	---	42.46	75,000	1,700	6,000	2,800	12,000	410*
5'-20'	Removed in August 2001, during remedial excavation activities										
RW-2	11/29/00	54.69	8.42	---	46.27	6,100	375	408	138	497	<100*
	3/21/01	54.69	7.45	---	47.24	4,920	147	14	59	90	<40*
Screen	6/5/01	54.69	10.59	---	44.10	12,000	320	19	80	120	21*
5'-20'	Removed in August 2001, during remedial excavation activities										
RW-3	11/29/00	54.52	8.23	---	46.29	4,710	129	21	<1.5	146	46.4*
	3/21/01	54.52	7.27	---	47.25	4,340	168	37	99.1	261	16.5*
Screen	6/5/01	54.52	8.91	---	45.61	9,300	230	15	52	58	19*
5'-20'	Removed in August 2001, during remedial excavation activities										
RW-4B	11/29/00	51.74	3.09	---	48.65	<50	0.3	1.3	0.4	2.9	<2.0*
	3/21/01	51.74	3.32	---	48.42	<50	0.6	<0.3	0.4	0.6	<2.0*
Screen	6/5/01	51.74	3.51	---	48.23	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
5'-20'	9/6/01	51.74	4.21	---	47.53	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	12/11/01	51.74	2.86	---	48.88	---	---	---	---	---	---
	3/12/02	51.74	3.56	---	48.18	<50	<0.5	<0.5	<0.5	1.1	<0.5*
	6/11/02	51.74	3.49	---	48.25	---	---	---	---	---	---

Table 3
GROUNDWATER ELEVATIONS AND
ANALYTICAL RESULTS
 Fortuna Beacon Petro Mart
 390 South Fortuna Boulevard
 Fortuna, California
 Blue Rock Project # FNC-3

Well No.	Sampling Date	TOC (feet)	DTW (feet)	*LNAPL (feet)	GWE (feet)	TPHg ($\mu\text{g/L}$)	Benzene ($\mu\text{g/L}$)	Toluene ($\mu\text{g/L}$)	Ethylbenzene ($\mu\text{g/L}$)	Xylenes ($\mu\text{g/L}$)	MTBE ($\mu\text{g/L}$)
RW-4B	9/9/02	55.90	3.82	---	52.08	---	---	---	---	---	---
	12/20/02	55.90	2.39	---	53.51	---	---	---	---	---	---
Screen	3/12/03	55.90	3.33	---	52.57	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
5'-20'	6/6/03	55.90	3.35	---	52.55	---	---	---	---	---	---
	9/17/03	55.90	4.75	---	51.15	---	---	---	---	---	---
	12/5/03	55.90	4.11	---	51.79	---	---	---	---	---	---
	3/15/04	55.90	3.23	---	52.67	<50	<0.5	<0.5	<0.5	<0.5	<0.5*
	6/9/04	55.90	3.73	---	52.17	---	---	---	---	---	---
	9/13/04	55.90	3.98	---	51.92	---	---	---	---	---	---
	12/10/04	55.90	2.83	---	53.07	---	---	---	---	---	---
	3/24/05	Covered over by structure									
RW-5	11/29/00	55.16	10.32	---	44.84	<2,500	229	46	36.1	15.3	254*
	3/21/01	55.16	6.94	---	48.22	1,330	54.3	10.4	25.7	116	26.9*
Screen	6/5/01	55.16	11.27	---	43.89	4,000	150	3.6	52	86	21*
5'-20'	9/6/01	55.16	15.59	---	39.57	3,400	240	15	43	33	28*
	12/11/01	55.16	10.33	---	44.83	8,100	280	26	120	320	39*
	3/12/02	55.16	8.30	---	46.86	2,100	180	1.9	32	5	19*
	6/11/02	55.16	13.08	---	42.08	1,900	440	2.3	48	7.9	34*
	9/9/02	58.30	15.58	---	42.72	3,100	410	7.8	39	26	20*
	12/20/02	58.30	5.88	---	52.42	4,900	200	8.5	73	350	26*
	3/12/03	58.30	10.71	---	47.59	1,200	120	0.61	16	<0.5	40*
	6/6/03	58.30	11.04	---	47.26	1,300	130	0.65	20	3.2	13*
	9/17/03	58.30	15.36	---	42.94	2,100	230	1.2	19	6.5	540*
	12/5/03	58.30	14.57	---	43.73	2,500	290	4.6	54	120	210*
	3/15/04	58.30	9.93	---	48.37	990	52	<0.5	13	<0.5	20*
	6/9/04	58.30	12.70	---	45.60	1,500	100	<0.5	9.5	1.4	37*
	9/13/04	58.30	15.08	---	43.22	910	55	0.73	5.7	2.1	31*
	12/10/04	58.30	5.98	---	52.32	4,400	110	2.3	43	300	11*
	3/24/05	58.30	6.36	---	51.94	3,900	120	2.1	41	190	13*
	6/1/05	58.30	12.33	---	45.97	1,600	71	0.57	16	4.8	11*
				MCL	---	1	150	300	1,750	13	
				Taste & odor threshold	5	---	42	29	17	5	

Notes:

TOC: Top of casing referenced to mean sea level in October 2002.

DTW: Depth to water measured from top of well casing in feet.

*LNAPL: Light Non-Aqueous Phase Liquid petroleum. Where listed in parentheses, it indicates the depth to LNAPL.

When LNAPL present, groundwater elevation calculated as: GWE = TOC - [DTW - 0.8(LNAPL)].

GWE: Ground water elevation as referenced to benchmark above mean sea level in feet.

TPHg: Total petroleum hydrocarbons as gasoline (EPA Method 5030/8015M)

Benzene, Toluene, Ethylbenzene, Xylenes: BTEX (EPA Method 8020, or 8260B)

MTBE: Methyl tertiary butyl ether (EPA Method 8020 or * by EPA Method 8260B)

<: Not detected at or above method detection limit as shown.

$\mu\text{g/L}$: micrograms per liter (~parts per billion)

"---": Not analyzed, available, or applicable.

MCL: primary maximum contaminant level, an enforceable California drinking water standard.

Calculation of Residual TPHg in Soil
Assuming contamination DOES NOT extend under dispenser islands
 Fortuna Beacon Petro Mart
 390 S. Fortuna Blvd., Fortuna, CA

TPHg mass (lbs) = \sum TPHg con. x (unitless) * Vol. x (ft³) * p (soil density, assume 100 lbs/ft³)

where,
 Vol. x (ft³) = Area x (ft²) * Thickness x (ft)
 TPHg con. x (mg/kg) = Average TPHg concentration for specific volume (see below)

5-foot depth interval (2.5 to 7.5 feet bgs)

TPHg >100 mg/kg

TPHg mass = Avg. TPHg con. * V * p

where,
 Avg. TPHg con. = Average TPHg concentration for this portion of plume ~320 mg/kg or 0.00032 unitless
 V = Volume of affected media = area (planimeter from map 1,262 ft² + 1,310 ft²) * thickness (5 ft)
 p = soil density (assumed to be 100 lbs/ft³)

TPHg mass (lbs) = $\frac{\text{Avg. TPHg con.} * V * p}{(\text{unitless}) \quad (\text{ft}^3) \quad (\text{lbs}/\text{ft}^3)}$

TPHg mass (lbs) = 0.00032 * 12,860 * 100

TPHg mass (lbs) = 412

10-foot depth interval (7.5 to 12.5 feet bgs)

TPHg >100 mg/kg

TPHg mass = Avg. TPHg con. * V * p

where,
 Avg. TPHg con. = Average TPHg concentration for this portion of plume ~250 mg/kg or 0.00025 unitless
 V = Volume of affected media = area (planimeter from map 4,439 ft²) * thickness (5 ft)
 p = soil density (assumed to be 100 lbs/ft³)

TPHg mass (lbs) = $\frac{\text{Avg. TPHg con.} * V * p}{(\text{unitless}) \quad (\text{ft}^3) \quad (\text{lbs}/\text{ft}^3)}$

TPHg mass (lbs) = 0.00025 * 22,195 * 100

TPHg mass (lbs) = 555

15-foot depth interval (12.5 to 17.5 feet bgs)

TPHg >100 mg/kg

TPHg mass = Avg. TPHg con. * V * p

where,
 Avg. TPHg con. = Average TPHg concentration for this portion of plume ~300 mg/kg or 0.00030 unitless
 V = Volume of affected media = area (planimeter from map 4,625 ft²) * thickness (5 ft)
 p = soil density (assumed to be 100 lbs/ft³)

TPHg mass (lbs) = $\frac{\text{Avg. TPHg con.} * V * p}{(\text{unitless}) \quad (\text{ft}^3) \quad (\text{lbs}/\text{ft}^3)}$

TPHg mass (lbs) = 0.0003 * 23,125 * 100

TPHg mass (lbs) = 694

20-foot depth interval (17.5 to 22.5 feet bgs)

TPHg >100 mg/kg

TPHg mass = Avg. TPHg con. * V * p

where,
 Avg. TPHg con. = Average TPHg concentration for this portion of plume ~950 mg/kg or 0.00095 unitless
 V = Volume of affected media = area (planimeter from map 5,587 ft²) * thickness (5 ft)
 p = soil density (assumed to be 100 lbs/ft³)

TPHg mass (lbs) = $\frac{\text{Avg. TPHg con.} * V * p}{(\text{unitless}) \quad (\text{ft}^3) \quad (\text{lbs}/\text{ft}^3)}$

TPHg mass (lbs) = 0.00095 * 27,935 * 100

TPHg mass (lbs) = 2,654

Total TPHg (lbs) =	4,314
Total TPHg (gals) =	707

Total Volume of TPHg Impacted Soil (in-situ) (ft ³) =	86,115
Total Volume of TPHg Impacted Soil (in-situ) (yd ³) =	3,189

Calculation of Residual TPHg in Soil
Assuming contamination DOES extend under dispenser islands

Fortuna Beacon Petro Mart
 390 S. Fortuna Blvd., Fortuna, CA

$$\text{TPHg mass (lbs)} = \sum \text{TPHg conc. x (unless)} * \text{Vol. x (ft3)} * p \text{ (soil density, assume 100 lbs/ft3)}$$

where,

$$\text{Vol. x (ft3)} = \text{Area x (ft2)} * \text{Thickness x (ft)}$$

TPHg conc. x (mg/kg) = Average TPHg concentration for specific volume (see below)

4-foot depth interval (2.5 to 7.5 feet bgs)

TPHg >100 mg/kg

$$\text{TPHg mass} = \text{Avg. TPHg conc.} * V * p$$

where,

Avg. TPHg conc. = Average TPHg concentration for this portion of plume ~320 mg/kg or 0.00032 unless

V = Volume of affected media = area (planimeter from map 1,262 ft2 + 2,583 ft2) * thickness (5 ft)

p = soil density (assumed to be 100 lbs/ft3)

$$\text{TPHg mass (lbs)} = \frac{\text{Avg. TPHg conc.} * V * p}{(\text{unless}) \quad (\text{ft3}) \quad (\text{lbs/ft3})}$$

$$\text{TPHg mass (lbs)} = 0.00032 * 19,225 * 100$$

$$\text{TPHg mass (lbs)} = 615$$

10-foot depth interval (7.5 to 12.5 feet bgs)

TPHg >100 mg/kg

$$\text{TPHg mass} = \text{Avg. TPHg conc.} * V * p$$

where,

Avg. TPHg conc. = Average TPHg concentration for this portion of plume ~250 mg/kg or 0.00025 unless

V = Volume of affected media = area (planimeter from map 5,919 ft2) * thickness (5 ft)

p = soil density (assumed to be 100 lbs/ft3)

$$\text{TPHg mass (lbs)} = \frac{\text{Avg. TPHg conc.} * V * p}{(\text{unless}) \quad (\text{ft3}) \quad (\text{lbs/ft3})}$$

$$\text{TPHg mass (lbs)} = 0.00025 * 29,595 * 100$$

$$\text{TPHg mass (lbs)} = 740$$

15-foot depth interval (12.5 to 17.5 feet bgs)

TPHg >100 mg/kg

$$\text{TPHg mass} = \text{Avg. TPHg conc.} * V * p$$

where,

Avg. TPHg conc. = Average TPHg concentration for this portion of plume ~300 mg/kg or 0.00030 unless

V = Volume of affected media = area (planimeter from map 6,640 ft2) * thickness (5 ft)

p = soil density (assumed to be 100 lbs/ft3)

$$\text{TPHg mass (lbs)} = \frac{\text{Avg. TPHg conc.} * V * p}{(\text{unless}) \quad (\text{ft3}) \quad (\text{lbs/ft3})}$$

$$\text{TPHg mass (lbs)} = 0.0003 * 32,200 * 100$$

$$\text{TPHg mass (lbs)} = 966$$

20-foot depth interval (17.5 to 22.5 feet bgs)

TPHg >100 mg/kg

$$\text{TPHg mass} = \text{Avg. TPHg conc.} * V * p$$

where,

Avg. TPHg conc. = Average TPHg concentration for this portion of plume ~950 mg/kg or 0.00095 unless

V = Volume of affected media = area (planimeter from map 7,439 ft2) * thickness (5 ft)

p = soil density (assumed to be 100 lbs/ft3)

$$\text{TPHg mass (lbs)} = \frac{\text{Avg. TPHg conc.} * V * p}{(\text{unless}) \quad (\text{ft3}) \quad (\text{lbs/ft3})}$$

$$\text{TPHg mass (lbs)} = 0.00095 * 37,195 * 100$$

$$\text{TPHg mass (lbs)} = 3,534$$

Total TPHg (lbs) =	5,885
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Total TPHg (gals) =	960
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Total Volume of TPHg Impacted Soil (in-situ) (ft ³) =	118,215
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Total Volume of TPHg Impacted Soil (in-situ) (yd ³) =	4,378
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Dual-Phase Extraction

The following description of dual-phase extraction is an excerpt from Chapter XI of OUST's publication: *How to Evaluate Alternative Cleanup Technologies for Underground Storage Tank Sites: A Guide for Corrective Action Plan Reviewers.* (EPA 510-B-95-007). This publication also describes 9 additional alternative technologies for remediation of petroleum releases.

Dual-phase extraction (DPE), also known as multi-phase extraction, vacuum-enhanced extraction, or sometimes bioslurping, is an *in-situ* technology that uses pumps to remove various combinations of contaminated groundwater, separate-phase petroleum product, and hydrocarbon vapor from the subsurface. Extracted liquids and vapor are treated and collected for disposal, or re-injected to the subsurface (where permissible under applicable state laws).

Application

DPE systems can be effective in removing separate-phase product (free product) from the subsurface, thereby reducing concentrations of petroleum hydrocarbons in both the saturated and unsaturated zones of the subsurface. DPE systems are typically designed to maximize extraction rates; however, the technology also stimulates biodegradation of petroleum constituents in the unsaturated zone by increasing the supply of oxygen, in a manner similar to that of bioventing. DPE is often selected because it enhances groundwater and/or product recovery rates, especially in layered, fine-grained soils. The application of DPE also maximizes the effectiveness of soil vapor extraction (SVE) by lowering the water table and therefore increasing air-phase permeabilities in the vadose zone.

Operation Principles

The vacuum applied to the subsurface with DPE systems creates vapor-phase pressure gradients toward the vacuum well. These vapor-phase pressure gradients are also transmitted directly to the subsurface liquids present, and those liquids existing in a continuous phase (*e.g.*, water and "free" petroleum product) will flow toward the vacuum well in response to the imposed gradients (the term "free" product is a commonly used, though imprecise term because a greater fraction of resident petroleum product may be recovered using vacuum-enhanced DPE compared to the fraction of product recoverable using gravity drainage alone). The higher the applied vacuum, the larger the hydraulic gradients that can be achieved in both vapor and liquid phases, and thus the greater the vapor and liquid recovery rates.

Dramatic enhancements in both water and petroleum product recovery rates resulting from the large hydraulic gradients attainable with DPE systems have been reported in the literature (Blake and Gates, 1986; Blake, *et al.*, 1990; Bruce, *et al.*, 1992). The depressed groundwater table that results from these high recovery rates serves both to hydraulically control groundwater migration and to increase the efficiency of vapor extraction. The remedial effectiveness of DPE within the zone of dewatering that commonly develops

during DPE application should be greater than that of air sparging due to the more uniform air flow developed using DPE (Johnson, *et al.*, 1992).

System Design

Although this general class of technologies is broadly referred to as dual-phase extraction, significant variations in the technology exist. DPE systems often apply relatively high vacuums to the subsurface. Thus, the adjective "high-vacuum" is sometimes used to describe DPE technologies, even though all DPE systems are not high-vacuum systems. DPE technologies can be divided into two general categories:

- 1) subsurface liquid(s) and soil vapor are extracted together as a high-velocity dual-phase (liquid(s) and vapor) stream using a single pump, or
- 2) subsurface liquid(s) and soil vapor are extracted separately using two or more pumps.

Single-Pump Systems. Single-pump systems rely on high-velocity airflow to lift suspended liquid droplets upwards by frictional drag through an extraction tube to the land surface. Single-pump vacuum extraction systems can be used to extract groundwater or combinations of separate-phase product and groundwater. Single-pump DPE systems represent a recent adaptation of the long-established technology known as "vacuum groundwater extraction". This technology has been used for many decades as a standard method for extracting groundwater to control seepage or effect dewatering during excavation, construction and mining activities. Single-pump DPE systems are generally better suited to low-permeability conditions, and they are difficult to implement at sites where natural fluctuations in groundwater levels are substantial. United States patents exist on certain applications of single-pump DPE systems (Hess *et al.*, 1991; Hajali *et al.*, 1992; Hess *et al.*, 1993). Single-pump DPE technology is sometimes referred to as bioslurping (Powers, 1994).

Dual-Pump Systems. The somewhat more conventional dual-pump systems use one pump to extract liquids from the well and a surface blower (the second pump) to extract soil vapor. A third DPE configuration uses a total of three pumps, including the surface blower together with one pump to extract floating product and one to extract groundwater. Both double- and triple-pump DPE systems extract the well liquids separately from the soil vapor and are similar in operation and application.

Dual-pump DPE systems are simply a combination of traditional soil vapor extraction (SVE) and groundwater (and/or floating product) recovery systems. Dual-pump systems tend to be more flexible than single-pump systems, making dual-pump systems easier to apply over a wider range of site conditions (*e.g.*, fluctuating water tables, wide permeability ranges); however, equipment costs are higher.

Advantages and Disadvantages

Advantages	Disadvantages
Proven performance over a wide range of conditions. Requires no downhole pumps, but is flexible enough to allow their use if necessary.	Single-pump systems are expensive to implement at sites with medium to high-permeability soils, and effectiveness. Dual-pump systems may not be effective in low permeability soils.
Minimal disturbance to site operations; can be used under buildings without excavation.	Difficult to apply to sites where the water table fluctuates unless water table depression pumps are employed.
Short treatment times (usually 6 months to 2 years under optimal conditions).	Treatment may be expensive for extracted vapors and for oil-water separation.
Substantially increases groundwater extraction rates.	Large volume of extracted groundwater may require treatment.
Can be applied at sites with free product, and can be combined with other technologies.	Requires specialized equipment with sophisticated control capability.
Can reduce the cost of groundwater treatment through air stripping within the vacuum extraction tube.	Requires complex monitoring and control during operation.

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